

FIELD RECORDS OF TURTLES, SNAKES AND LIZARDS IN MYANMAR (2009–2017) WITH NATURAL HISTORY OBSERVATIONS AND NOTES ON FOLK HERPETOLOGICAL KNOWLEDGE

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ABSTRACT

The herpetofauna of Myanmar remains one of the least studied and poorly known in Asia, and even basic distributional and natural history data are lacking for many species. This situation is particularly alarming given the need for such data when prioritizing conservation action and crafting effective management plans. Furthermore, ethnobiological investigations have long been neglected in Myanmar despite the ethnic diversity of the country. We here report field observations with accompanying locality data for turtles (18 species), snakes (27 species), and lizards (7 species) from western, central, eastern, and southern regions of Myanmar during 2009–2017. We also present natural history observations, and information on folk herpetological knowledge and conservation status of selected species.

Keywords: biodiversity, Burma, conservation, herpetofauna, Myanmar, Serpentes, Squamata, Testudines

INTRODUCTION

Despite high levels of species richness (at least 295 species [WOGAN *ET AL.*, 2008]), the herpetofauna of Myanmar remains one of the least studied and poorly known in Asia (VAN DIJK, 1997; ZUG *ET AL.*, 1998; DAS, 2000; LEVITON *ET AL.*, 2008; WOGAN *ET AL.*, 2008). Geographic distribution data for most species are fragmentary with much information dating to the British Colonial era (VAN DIJK, 1997; PLATT *ET AL.*, 2007; WOGAN *ET AL.*, 2008). With the exception of inventories conducted by the Myanmar Forest Department in collaboration with Smithsonian

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Institution and California Academy of Sciences (reviewed by WOGAN *ET AL.*, 2008) that focused primarily on the protected area network (e.g. ZUG *ET AL.*, 1998), chelonian inventories undertaken at widely disparate locations by Wildlife Conservation Society/Turtle Survival Alliance (e.g. PLATT *ET AL.*, 2001, 2005, 2007), and baseline surveys of crocodile populations (THORBJARNARSON *ET AL.*, 2000a; WIN KO KO & PLATT, 2012; PLATT *ET AL.*, 2014b, 2015), the herpetofauna of Myanmar remains understudied and basic distributional data are lacking or incomplete for many species (PLATT *ET AL.*, 2000; LEVITON *ET AL.*, 2008; WOGAN *ET AL.*, 2008).

This situation is especially lamentable given the anthropogenic threats faced by reptiles both regionally (THIRAKHUPT & VAN DIJK, 1994; DAS, 2000; PLATT *ET AL.*, 2000; VAN DIJK *ET AL.*, 2000; NIJMAN & SHEPHERD, 2015) and globally (GIBBONS *ET AL.*, 2000; READING *ET AL.*, 2010; ROBINSON *ET AL.*, 2015) because understanding species distributions is fundamental to the study of biogeography, ecology, and conservation biology (McDIARMID, 1994; MCCARTHY *ET AL.*, 2011; LINDEMAN, 2014) and acquiring basic distributional data on even common species is essential for prioritizing conservation action and developing effective management plans (DODD & FRANZ, 1993; STUART & THORBJARNARSON, 2003; LI *ET AL.*, 2016). Moreover, conservation measures are more likely to prove successful when based on a thorough understanding of the natural history of an organism (DAYTON, 2003), which in general, is poorly known for most reptiles in Southeast Asia (VAN DIJK, 1997; COX *ET AL.*, 2010; DAS, 2010).

Furthermore, folk herpetological knowledge, which we here define as including both traditional ecological knowledge (TEK; defined as “the cumulative body of knowledge concerning the relationship of organisms to one another and their environment, empirically acquired, and passed down by oral tradition”; BERKES *ET AL.*, 2000, HUNTINGTON, 2000) and ethnoherpetology (defined as “the relationships between human culture and reptiles”; ALVES *ET AL.*, 2012) of various ethnic groups in Myanmar has long been neglected by investigators (PLATT *ET AL.*, 2004). Cultural knowledge of plants and animals is often encoded in terms specific to individual languages, and linguistic diversity is considered an index of the specialized ethnobiological knowledge of a region (NABHAN, 2003). Because over 100 distinct languages and dialects are spoken in Myanmar (DIRAN, 1997), the country appears to offer a fertile ground for ethnobiological investigation (PLATT *ET AL.*, 2004). Although science has been slow to embrace TEK as a research method for a variety of reasons (HUNTINGTON, 2000; NADASDY, 2003), a growing body of evidence indicates indigenous peoples are keen observers of the natural world and can be reliable sources of information on local flora and fauna (NEWTON *ET AL.*, 2008; KANAGAVEL & RAGHAVAN, 2012; MEIJAARD *ET AL.*, 2011; NABHAN & MARTINEZ, 2012). Indigenous ethnobiological knowledge can provide insights into natural history and ecological relationships over-looked by academic investigators, as well as utilitarian benefits in the form of novel pharmaceuticals and natural products, and can also provide a greater understanding of biological and cultural diversity (GOODMAN & HOBBS, 1994; BERKES, 1999; NABHAN, 2003). Furthermore, because indigenous peoples often have an empirical understanding of fauna, flora, and complex ecological systems, folk knowledge can be used to inform conservation and management planning designed to safeguard local biodiversity (GADGIL *ET AL.*, 1993; ANÁDON *ET AL.*, 2009; FERRONATO & CRUZADO, 2013).

We here report field observations with accompanying locality data for turtles, snakes and lizards from western, central, eastern and southern Myanmar (regions according to KING *ET AL.*, 1975). We also present natural history observations, information on folk herpetological knowledge (including methods of exploitation), and additional commentary on selected species.

METHODS

The data we present in this paper were collected during fieldwork conducted from 2009 through 2017 as a part of our larger investigations into the conservation status of globally and regionally threatened chelonians in Myanmar (PLATT *ET AL.*, 2008; PLATT *ET AL.*, 2003c, 2010a, 2012b, 2013, 2014a, 2014c, 2017b). During these investigations, we conducted numerous semi-structured, open-ended interviews (MARTIN, 1995; GILCHRIST *ET AL.*, 2005) with rural villagers to gather information on turtles and other wildlife. Interviews were conducted in Burmese by native speakers and later translated into English. As a part of these interviews, we asked to examine any living turtles or shells that might be available; the latter are often kept for hunting trophies, medicinal purposes, food containers for domestic animals, rice scoops, or future sale to visiting traders (STUART & PLATT, 2004). Turtle shells (particularly plastrons) are ultimately destined for wildlife markets in southern China where soothsayers use them to divine the future (PLATT *ET AL.*, 2000, 2003b). Unlike trade specimens for which the provenance can be difficult or impossible to reliably determine, shells obtained in villages are generally from turtles collected nearby (STUART & PLATT, 2004; PLATT *ET AL.*, 2014a). Identifying the dried carapaces of softshell turtles occasionally proved challenging. We used the presence of tubercles on the anterior carapacial margin to distinguish *Amyda cartilaginea* from others, and prominent (but sometimes faded) carapacial ocelli to identify *Nilssonina formosa*. Nonetheless, some dried carapaces from softshell turtles could not be reliably identified and thus are not included herein. Our records of Elongated Tortoise (*Indotestudo elongata*) will be presented elsewhere. Likewise, previously published records (e.g. PLATT *ET AL.*, 2010a, 2012b, 2013, 2014a, 2014c, 2015; SAW HTUN & PLATT, 2016; PLATT *ET AL.*, 2017b) are omitted from this account. For the most part we omit observations of turtles in pagoda ponds as rarely can the provenance of these turtles be established with any reliability and visiting pilgrims frequently transport turtles considerable distances from the point of capture (e.g. PLATT *ET AL.*, 2008). Exceptions were made when turtles were of conservation interest or ponds are unenclosed, semi-natural earthen waterbodies with the potential for turtles to disperse into nearby wetlands (e.g. *Trachemys scripta elegans*).

Living turtles and shells were measured (straight-line carapace length [CL; measured along the mid-line from the posterior marginals to the anterior edge of the nuchal scute] and plastron length [PL; measured along the mid-line from the base of the anal notch to the posterior edge of the gular scute]) with calipers and photographed. Measurements (CL and PL) of living softshell turtles include the pliable margins of the carapace and plastron; however, because this part of the shell is generally removed when softshell turtles are butchered, measurements of these shells include only the underlying bony disk. We sexed turtles according to plastral and tail morphology, although in many cases only a carapace was available, making the determination of sex impossible. Likewise, we were unable to reliably determine the sex of some species (e.g. *Cyclemys* spp.) based solely on shell attributes, although living turtles could usually be sexed according to differences in tail morphology. We frequently accompanied villagers to specific sites where turtles had recently been captured in order to qualitatively describe the habitat. Additionally, we searched appropriate habitat for turtles, with the occasional assistance of locally available hunting dogs (PLATT *ET AL.*, 2003b).

On several occasions we obtained living turtles from villagers and incorporated these animals into assurance colonies (defined as demographically and genetically viable captive-breeding groups of imperiled taxa maintained as a hedge against the extinction of wild popula-

tions; BUHLMAN *ET AL.*, 2002) operated by the Myanmar Forest Department in collaboration with the Wildlife Conservation Society/Turtle Survival Alliance Myanmar Program. The ultimate objective of these assurance colonies is to produce offspring for head-starting and eventual reintroduction into the national protected area system (PLATT *ET AL.*, 2014a; PLATT *ET AL.*, 2017a).

Records of snakes and lizards are for the most parts the results of opportunistic encounters during other fieldwork; however, we also examined specimens killed by villagers for food or safety reasons (varanids and large snakes), or found dead on roads (DOR). Most Tokay (*Gekko gecko*) records are based on vocalizations, which are distinctive and readily identified (COX *ET AL.*, 2010). If possible, we measured total length (TL) and snout-vent length (SVL) and determined sex of snakes and lizards by manual examination of the cloaca. Most (but not all) specimens of snakes and lizards were photographed to facilitate identification.

Geographic coordinates (degrees, minutes and seconds) and altitude (meters above sea level) of locations of interest were determined with Garmin® GPS 12 and 76 (Appendix 1). Place names are in accordance with a countrywide gazetteer currently being compiled by the Myanmar Forest Department, although local names are used for those locations not included in the gazetteer. Administrative units formerly known as “Divisions” are now designated by the Government of Myanmar as “Regions”.

CONVENTIONS

The taxonomic arrangement and nomenclature of our species accounts for the most part follow DAS (2010). Within each species account, records are grouped by state or region (in alphabetical order) and then presented in chronological order. The given date refers to the date we examined the specimen, not necessarily when it was collected (e.g. turtle shells obtained from villagers). Because multiple records often originated from the same location, to avoid redundancy in the text we provide geographic coordinates of villages and temporary camps in Appendix 1. Coordinates of field observations not associated with a village or encampment are embedded in the respective species account. When available, information on habitat, circumstances surrounding the record, and any natural history observations follows the location. Habitat descriptions in the accounts are in loose accordance with HUNDLEY (1961), DAVIS (1964), and PLATT *ET AL.* (2010b) with modifications based on our observations. A section on Folk Knowledge follows the compendium of records in each species account. Under Folk Knowledge we include vernacular names (if available), TEK, and describe harvest practices, the use of a particular species for food, medicine, or other purposes, and any associated cultural practices or beliefs. Accounts of folk knowledge are heavily weighted towards chelonians, reflecting the primary emphasis of our research. Finally, we conclude each species account with a Comment section if warranted.

SPECIES ACCOUNTS

TURTLES

Geoemydidae

Batagur “*baska*” (Northern River Terrapin)

Ayeyarwady Region: Shell (Fig. 1) consisting of an intact plastron (PL = 310 mm) and disarticulated carapace (CL = 320 mm) found by fisherman ca. 2007 on Gaoyatgyi Kyun (27 January 2017).

Comments: Taken together, the large size of the carapace and plastron, distinctive oval shape of the carapace, pronounced anterior truncation of the plastron, and obvious heavy buttressing of the plastral bridge make this shell clearly assignable to the genus *Batagur* (SMITH, 1931; MOLL *ET AL.*, 2009, 2015). Although *B. baska* and *B. trivittata* are known to have once occurred in great abundance in the Ayeyarwady Delta (MAXWELL, 1911), the carapace of the shell from Gaoyatgyi Kyun lacks the characteristic keel of *B. trivittata* and hence is assignable to either *B. baska* or *B. affinis*. To our knowledge, these two species of *Batagur* cannot be separated solely on the basis of shell attributes, but the well-documented historical abundance of *B. baska* in the Ayeyarwady Delta coupled with the fact that the nearest known populations of *B. affinis* are in extreme southern Thailand near the Thai-Malaysia frontier (range map in MOLL *ET AL.*, 2015), suggest that *B. baska* is the most likely referent for the material found on Gaoyatgyi Kyun. However, in light of this uncertainty, we provisionally include this material in our accounts as *B. baska* while recognizing these bones could be those of *B. affinis*. Although a small number of *B. baska* apparently survived in the Ayeyarwady Delta as late as the early 2000s (PLATT *ET AL.*, 2008), both *B. baska* and *B. trivittata* have long been considered functionally extinct in the region (THORBJARNARSON *ET AL.*, 2000b; PLATT *ET AL.*, 2008).

In May 2012, we revisited Pyin Won Sandbank (12°19'56"N; 98°48'28"E; altitude 2 m) along the Tanintharyi River (Tanintharyi Region) where *B. baska* (or less likely *B. affinis*; see MOLL *ET AL.* [2006, 2015] for uncertainty surrounding respective distributions of *B. baska* and *B. affinis* in southern Myanmar) nesting was previously confirmed (PLATT *ET AL.*, 2008). We found much of the sandbank had been removed during extensive commercial sand dredging operations with the remaining portion now buried in deep mud and supporting mangrove vegetation. To our knowledge, this was the last confirmed nesting site for *B. baska* in Myanmar.

Batagur trivittata (Burmese Roofed Turtle)

Mandalay Region: Carapace (CL = 475 mm) in Nat Hmaw Do along the Ayeyarwady River. Kept as a family heirloom; otherwise little information could be gleaned about this shell other than the turtle was “harvested an uncountable number of years ago” (i.e. the shell was very old) from the Ayeyarwady River (5 November 2015). Informants had no first-hand knowledge of *B. trivittata*, making it difficult to establish when this species became locally extinct. **Sagaing Region:** Intact shell of female (CL = 540 mm; PL = 499 mm) obtained from two professional fishermen in Kindat; turtle was accidentally drowned in fishing net set in the Chindwin River approximately 30 km downstream from Limpha Village in 2001 (12 February 2012). *Batagur trivittata* reportedly nested on sandbank across from Kindat on west bank of the Chindwin River where villagers harvested eggs; last known nesting occurred about 1980. Shell of female (CL = 555 mm, PL = 520 mm) from the Chindwin River at

Limpha (22 February 2012); salvaged from turtle that drowned in a fishing net in early 2000s. Carapaces (CL = 490, 505 and 510 mm) of three turtles from the Chindwin River at Limpha (26 February 2012); shells salvaged from turtles that drowned in fishing nets >20 years ago. Fragments of carapace and plastron from two turtles examined in Nam Thalet (20 February 2013); turtles killed by dynamite fishing in Nam Thalet Chaung (tributary of Chindwin River) ca. 2001–2003. Complete shell of female (CL = 506 mm, PL = 475 mm) captured in 1991 or 1992 examined in Naung Pin (9 March 2013).

Folk knowledge: A resident of Kanaung reportedly found the trackway of a nesting female in the “mid-1980s” and unsuccessfully attempted to locate the clutch. According to a monk dwelling at Ngar Hnar Pagoda in Hinthada, as many as five very large hard-shelled turtles were kept in the pagoda pond >35 years ago, but later released into the nearby the Ayeyarwady River. A fisherman at Duyar In reportedly excavated a clutch of large, hard-shelled eggs (described as similar to duck eggs in size and shape) from a sandbar along the nearby the Ayeyarwady River “about 30 years ago” (ca. 1985). This description is consistent with the eggs of *Batagur trivittata* (PLATT *ET AL.*, 2005; KUCHLING *ET AL.*, 2006). At that time, area residents considered *B. trivittata* to be extremely rare along the lower Ayeyarwady River. Although distinguishing between *B. trivittata* and *B. baska* can be difficult when interpreting local accounts, in view of the inland locations of these reports coupled with the largely coastal distribution of *B. baska* (MAXWELL, 1911), we consider *B. trivittata* as the most likely referent.

Carapace of large turtles were formerly used to transport cattle manure to nearby fields. Dried carapaces also served as drinking vessels for poultry; birds that drank water from an upturned shell were thought to be protected from a variety of avian diseases. A preparation for treating hemorrhoids was made by boiling pulverized shell together with the root of *Ma-U* (species undetermined) until most of the solution has evaporated; the concentrate was then consumed as a soup. A mixture of pulverized turtle shell, powdered shells from a marine mollusk, and lime juice is said to be an effective treatment for a skin disease that causes the loss of epidermal pigmentation. The mixture is applied as a paste to the affected area.

Comments: Our records highlight the danger that incidental capture in fishing gear poses to *B. trivittata* (see also KUCHLING *ET AL.*, 2006). Our interviews with villagers suggest that a few *B. trivittata* survived in the lower Ayeyarwady River as recently as the 1980s.

***Cuora amboinensis* (Malayan Box Turtle)**

Sagaing Region: Eight plastrons from turtles harvested locally for domestic consumption in Ayaw Daw (22 March 2014). Our sample consisted of two males (PL = 140 and 157 mm) and six females (PL = 139, 157, 159, 162, 165 and 165 mm), distinguished by plastral morphology (Fig. 2). These turtles reportedly were captured in grass swamps (= *Khaing Daw*) characteristic of heavy clay soils near Ayaw Daw (Fig. 3).

Folk knowledge: *Cuora amboinensis* is known locally as *Leik Gin Joe* (= turtle with a broken plastron), an obvious reference to the hinged plastron. Many *Khaing Daw* wetlands have been converted to rice fields and several informants stated *C. amboinensis* populations had declined as a result. Two villagers reported finding 2–3 shelled eggs in the reproductive tracts of female *C. amboinensis*, a number consistent with other reports (SCHOPPE & DAS, 2011). For harvest methods see *Melanochelys trijuga edeniana* account.

Comments: *Cuora amboinensis* in upper Myanmar has been assigned to the subspecies *C. amboinensis kamaroma* by ERNST *ET AL.* (2016) based on a range-wide review of morphological variation. However, RHODIN *ET AL.* (2017) reject this taxonomy and instead follow



Figure 1. Plastron and carapace presumed to be a Northern River Terrapin (*Batagur baska*) found on Gaoyatgyi Kyun, Ayeyarwady Region in 2007. Photograph by Steven G. Platt.



Figure 2. Plastrons of Malayan Box Turtles (*Cuora amboinensis*) in Ayaw Daw, Sagaing Region (22 March 2014). Plastron at upper left is from an Elongated Tortoise (*Indotestudo elongata*). Photograph by Steven G. Platt.



Figure 3. Grass swamps known as *Khaing Daw* where Malayan Box Turtles (*Cuora amboinensis*) and Burmese Black Turtle (*Melanochelys trijuga edeniana*) were captured by villagers near Ayaw Daw, Sagaing Region. Photograph by Steven G. Platt.



Figure 4. Female Keeled Box Turtle (*Cuora mouhotii*) found in forested hills above Limpha, Sagaing Region (7 June 2017). Photograph by Kalyar Platt.

MCCORD & PHILIPPEN (1998) in recognizing *C. amboinensis lineata* as a valid subspecies in upper Myanmar. *Cuora amboinensis* has not been previously reported from Sagaing Region and our records from Ayaw Daw constitute a significant range extension from earlier collections in Kachin State (SCHOPPE & DAS, 2011). Our records from Sagaing also narrow the distributional hiatus between *C. amboinensis kamaroma* in Nagaland and Assam in India, and *C. amboinensis lineata* in upper Myanmar.

Cuora mouhotii (Keeled Box Turtle)

Sagaing Region: Adult female (Fig. 4) found in dense understory of old second-growth evergreen forest on a sandstone hillside (river terrace) above Limpha (7 June 2017).

Comments: Previously reported from Sagaing Region in second-growth forests of the Naga Hills on west bank of the Chindwin River (PLATT *ET AL.*, 2013). Additional records are available from near Myitkyina and northern Kachin State (IVERSON, 1992; DAS *ET AL.*, 2016). Otherwise, the distribution of *C. mouhotii* within Myanmar remains ill-defined and poorly known.

Cyclemys fusca (Gray Leaf Turtle)

Ayeyarwady Region: Juvenile (CL = 131 mm, PL = 115 mm) among submerged rocks in Zaduta Chaung (17°47'47"N; 94°54'49"E; altitude 227 m) on 20 May 2009; streamside habitat consisted of bamboo (*Melocanna baccifera*) brake with scattered evergreen trees. Adult female (CL = 183 mm, PL = 158 mm) among rocks in Myar Chaung (18°06'55"N; 94°57'08"E; altitude 302 m) on 5 January 2011; streamside habitat consisted of evergreen forest. **Chin State:** Carapace (CL = 191 mm) in Walanpi (6 November 2012). **Rakhine State:** Carapace (CL = 216 mm) examined at Kyen Khar Kone Basecamp (28 May 2009); turtle captured nearby in small stream in dense bamboo. Juvenile (CL = 150 mm; Fig. 5) found in shallow (ca. 20 cm), swift-flowing water beneath weathered elephant (*Elephas maximus*) mandible in Kyet Hlut Chaung, approximately 5 km upstream from Kyen Khar Kone Basecamp (30 May 2009). Streamside habitat consisted of scattered patches of evergreen forest and dense bamboo. Male (CL = 190 mm, PL = 178 mm) found among rocks in small creek in evergreen forest near Kanyin Gyauk Basecamp (31 May 2013). Small pieces of partially digested fruits present in feces. **Sagaing Region:** Carapace (CL = 156 mm) in Nam Thalet Village (17 February 2013). Plastron (PL = 207 mm) lacking an associated carapace in Sone Inn Yar (18 February 2013). Living turtle (CL = 159 mm, PL = 147 mm) from Wa Daw (19 February 2013). Two complete shells (CL = 215 mm, PL = 198 mm and CL = 154 mm, PL = 119 mm) and five plastrons (PL = 165, 181, 188, 193 and 195 mm) from Mol Dun (24 February 2013). Carapace (CL = 200 mm) found along footpath (22°19'21"N; 94°27'12"E; altitude 614 m) in undisturbed deciduous forest above Thabeiksay in Alaung Daw Kathapa National Park; damage to shell indicated the turtle had been killed by hunters, most likely within previous six months (19 November 2013). Adult (CL ca. 250 mm) observed basking on horizontal partially submerged log along a stretch of relatively deep (6–10 ft) water in Nam Thalet Chaung, approximately 19 km upstream from Htamanthi (29 March 2015). Small juvenile (CL = 58 mm, PL = 49 mm) found where Nam Pelin Chaung debouches into the Chindwin River at Chaung Wa; filamentous algae covered both forelegs (28 February 2016). Juvenile (CL = 57 mm, PL = 48 mm) found by villager in shallow water of Nam Pelin Chaung at Chaung Wa (4 March 2016). Juvenile (CL = 74 mm, PL = 63 mm) captured in fish trap set in near-dry forested swamp at Limpha (17 March 2016). Small adult male (CL = 118 mm, PL =

110 mm) captured in the Chindwin River at Sein Naing Sandbank (25°57'5"N; 95°36'52"E; altitude 130 m) on 22 February 2017. Juvenile (CL ca. 80 mm) observed in shallow creek in broadleaf forest near Chaung Wa Wetland (25°46'14"N; 95°31'30"E; altitude 127 m); turtle was floating on surface and appeared to be basking in patch of sunlight; escaped into dense algal mat (25 February 2017).

Folk knowledge: A hunter in Chin State reported finding seven eggs when butchering a female turtle. *Cyclemys fusca* said to be found along Nam Thalet Chaung and tributary streams to an elevation of approximately 600 m in Sagaing Region. *Cyclemys fusca* is subject to widespread subsistence harvest in western Myanmar, but rarely purchased by commercial wildlife traders owing to the strong smell of the meat (see below). Although not particularly valuable, plastrons are sometimes retained for later sale to itinerant merchants that occasionally visit villages. *Cyclemys fusca* are reportedly captured on baited fishhooks and in fish traps, and occasionally fall victim to deadfall traps (described by MASON [1901]) set for small mammals. Because most captures are opportunistic, annual harvest levels appear low, ranging from 2–3 turtles/villager. The vernacular name *Leik Poke* (= Odiferous Turtle) is widely applied to *C. fusca* in western Myanmar owing to the strong smell associated with the turtle, which is most pronounced when turtles are prepared as food. Some villagers shun consumption of *C. fusca* for this reason.

Comments: Collectively, our records and others (IVERSON, 1992; FRITZ *ET AL.*, 2008; PLATT *ET AL.*, 2012b, 2013) indicate *C. fusca* is widely distributed throughout western Myanmar and occurs in a variety of aquatic habitats including swift-flowing, rocky upland streams, lowland creeks, alluvial wetlands, and occasionally larger rivers. Despite the plethora of distributional records, the natural history of *C. fusca* remains largely unknown.

Cyclemys oldhamii (Oldham's Leaf Turtle)

Shan State: Carapace (CL = 194 mm) examined in Aung Myay; turtle reportedly captured in swift-flowing rocky stream near village (13 December 2014). **Tanintharyi Region:** Intact shell (CL = 215 mm, PL = 205 mm) at Yuzana Camp; captured in evergreen tropical forest being cleared for oil palm plantations (7 May 2012). Carapace (CL = 213 mm) at Karathuri (7 May 2012). Plastron (PL = 190 mm) in Chauk La Maing (8 May 2012). Living juvenile (CL = 82 mm, PL = 73 mm; Fig. 6) captured in second-growth evergreen forest near Taung Dagon (9 May 2012). Intact shell (CL = 193 mm, PL = 185 mm) from female in Chaung Lamu (13 May 2012). Turtle was captured nearby and butchered on 10 May 2013. Dried yolk adhering to the plastron suggested the turtle was gravid when butchered. Disarticulated carapace (CL = 172 mm) and plastron (PL = 164 mm) in Zew Wei (14 May 2012). Carapace (CL = 197 mm) found at abandoned hunting camp (10°52'17"N; 98°03'48"E; altitude 38 m) near Salet Galet (Lampi Island Marine National Park) on 16 December 2013. The camp was located along shallow rocky stream in tropical evergreen forest.

Folk knowledge: *Cyclemys oldhamii* is subject to widespread subsistence harvest throughout eastern and southern Myanmar. Similar to *C. fusca*, some villagers refrain from consuming *C. oldhamii* owing to a strong odor associated with the meat. Some residents of Lampi Island believe that consuming *C. oldhamii* will bring misfortune to the transgressor.

Comments: The specimen we found near Salet Galet (16 December 2013) is the first record of *C. oldhamii* from Lampi Island National Park or elsewhere in the Myeik Archipelago (IVERSON, 1992; BEFFASTI & GALANTI, 2011). The nearest populations occur on mainland of Tanintharyi Region, a distance of about 25 km.



Figure 5. Juvenile Gray Leaf Turtle (*Cyclemys fusca*) from swift-flowing stream near Kyen Khar Kone Basecamp, Rakhine State (30 May 2009): lateral view (A) and plastral view (B). Photographs by Steven G. Platt.



Figure 6. Anterior view of juvenile Oldham's Leaf Turtle (*Cyclemys oldhamii*) found in second-growth forest near Taung Dagon, Tanintharyi Region (9 May 2012). Photograph by Steven G. Platt.



Figure 7. Juvenile Leaf Turtle (*Cyclemys* sp.) from Thabwe Chaung in North Zamari Wildlife Sanctuary of Bago Yoma Hills, Bago Region (12 November 2016). Note the plastral coloration which differs markedly from that of *Cyclemys fusca* and *C. oldhamii* in Myanmar. Photograph by Steven G. Platt.



Figure 8. Giant Asian Pond Turtle (*Heosemys grandis*) photographed in A Mar Township, Ayeyarwady Region in 2013 and later released at Meinmahla Kyun Wildlife Sanctuary (photograph courtesy of U Cho Hla).

Cyclemys sp. (Leaf Turtle)

Bago Region: Juvenile (CL = 63 mm, PL = 53 mm; Fig. 7) found crossing road at Thabwe Chaung Bridge (18°04'48"N; 96°01'40"E; altitude 165 m) in North Zamari Wildlife Sanctuary (12 November 2016). Plastron (PL = 185 mm) from turtle harvested by villager in Zamari Chaung Camp (17 November 2016). Carapace (CL = 175 mm) obtained from villager on Chaung Gwa Island in Ye New Reservoir (22 November 2016).

Comments: The juvenile from Thabwe Chaung appeared unlike similar-sized *C. fusca* we examined in western Myanmar. Most notably, the dark-colored head and neck exhibited light (almost white) horizontal striping on the lateral surface and around the jaws. Furthermore, the plastron was light brown with a red-orange tint and black blotches clustered along the sutures, in contrast to that of *C. fusca* which is more uniformly dark and lacks prominent blotches. The only specimen from the Bago Yoma Hills (encompassing North Zamari Wildlife Sanctuary) included in the analysis of FRITZ *ET AL.* (2008) was considered a putative *Cyclemys fusca* × *oldhamii* hybrid. In light of this phenotypic ambiguity, the taxonomic status of *Cyclemys* in the Bago Yoma Hills is in need of further clarification.

Heosemys depressa (Arakan Forest Turtle)

Ayeyarwady Region: Carapace (CL = 264 mm) from timber cutter in Kone Pyin (15 May 2010); turtle was buried beneath leaf litter in bamboo brake when captured. Carapace and plastron (CL = 253 mm, PL = 218 mm; annuli indistinct and worn) of male harvested 10 days prior to our visit (28 May 2010); turtle captured at base of the Arale Chaung Waterfall (17°53'52"N; 94°55'50"E; altitude 335 m) in evergreen forest along creek with bamboo brake on adjacent slopes. Carapace (CL = 237 mm) from Htan Pinkone (30 May 2010). Carapace and plastron (CL = 221 mm, PL = 182 mm, annuli = 12) of female from Done Ahing Kyaw (30 December 2010). Plastron with incomplete carapace of male found beneath rocks in dry creek bed (18°07'55"N; 94°56'39"E; altitude 396 m) of Nga Bhat Sei (1 January 2011). Female (CL = 243 mm, PL = 229 mm, annuli = 18) found with aid of a dog among leaf litter in bamboo brake with scattered evergreen trees on Kwet Twin Gyi Ridge (18°08'09"N; 94°55'08"E; altitude 482 m) on 4 January 2011. **Rakhine State:** Male (CL = 232 mm, PL = 190 mm, annuli = 17) found with dogs among dense understory (altitude = 124 m) in evergreen forest on hills above Thaw Ka–Kyet Chaung (16 June 2017). Female (CL = 178 mm, PL = 156 mm, annuli = 9) found with dogs among shrubs in clearing (elevation = 122 m) in evergreen forest on hills above Thaw Ka–Kyet Chaung (18 June 2017). Male (CL = 220 mm, PL = 176 mm, annuli = indistinct; at least 20) found with dogs in herbaceous understory (altitude 126 m) of evergreen forest in hills above Thaw Ka–Kyet Chaung (20 June 2017).

Folk knowledge: Vernacular names for *H. depressa* include *Byant Leik* (= Turtle with flattened carapace), *Rakhine Taung Leik* (= Mountain Turtle of Rakhine [Arakan] Hills), and *Taung Leik* (= Mountain Turtle). The latter name is also applied to *Indotestudo elongata* in many areas of Myanmar. Hunters use dogs to find *H. depressa*, which are kept for domestic consumption. Hunters often search beneath fruiting *Dillenia pentagyna* trees; other turtles are found when burning swidden plots during late dry season in preparation for planting.

In addition to foods listed by PLATT *ET AL.* (2003a, 2003b, 2010a, 2014c), our informants reported that *H. depressa* consume the fallen fruits of *Erythrina suberosa*, *Magnifera caloneura*, *Artocarpus chalapasha*, the leaves and flowers of *Homalomena* spp., and several species of mushrooms. According to hunters in Thaw Ka–Kyet Chaung, the succulent stems of *Amorphophallus* sp., a common understory plant often growing in abandoned swidden fields,

are a major component of the wet season diet. Hunters locate potential search areas by noting the presence of partially consumed *Amorphophallus* stems. During fieldwork near Thaw Ka–Kyet Chaung (June 2017), we observed numerous partially consumed *Amorphophallus* stems at sites where *H. depressa* were captured, lending credence to information provided by local hunters.

Comments: Our records are the first for *H. depressa* from Ayeyarwady Region and the drier eastern slopes of the Rakhine (Arakan) Yoma Hills. Populations on the eastern slopes of the Rakhine Yoma Hills in Ayeyarwady Region are probably contiguous with those in Rakhine (PLATT *ET AL.*, 2003a, 2003b, 2010a) and Chin (PLATT *ET AL.*, 2014a) States in Myanmar, and the Chittagong Hills in eastern Bangladesh (RAHMAN *ET AL.*, 2015). Our records of *H. depressa* from Thaw Ka–Kyet Chaung complete a distributional hiatus between populations found near An (PLATT *ET AL.*, 2003b) and those along Kyentali Chaung (PLATT *ET AL.*, 2010a). Hunters in the southern Chin Hills likewise report that *Amorphophallus* sp. is important in the diet of *H. depressa* (PLATT *ET AL.*, 2014a).

Heosemys grandis (Giant Asian Pond Turtle)

Ayeyarwady Region: Photorecord of an adult (Fig. 8) provided by staff of Meinmahla Kyun Wildlife Sanctuary (MKWS) (30 January 2017). Photograph was taken in 2013 by U Cho Hla in A Mar Township of Ayeyarwady Region. This turtle was later released at Mauk Tayar Camp in MKWS. Sanctuary staff also reportedly observed young *H. grandis* in a freshwater wetland near Thauung Chaung Camp (MKWS) in 2016. **Tanintharyi Region:** Carapace (CL = 288 mm) in Le Taung Yar (12 May 2012). One living female (CL = 280 mm, PL = 267 mm), and three intact shells (male, CL = 373 mm, PL = 306 mm; female, CL = 184 mm, PL = 167 mm; female, CL = 191 mm, PL = 178 mm) in Shan Inn Daw (13 May 2012). These turtles were captured in nearby palm swamp described by PLATT *ET AL.* (2014b). Intact shell (CL = 298 mm, PL = 269 mm; male), two plastrons (PL = 254 and 265 mm; both males), and a carapace (CL = 303 mm) in Chaung Lamu (13 May 2012). Intact shell of adult female (CL = 253 mm, PL = 239 mm) in Ye Phyu (13 May 2012). Carapace (CL = 205 mm) in Zew Wei (14 May 2012).

Folk knowledge: *Heosemys grandis* is known locally as *Thinbaung Leik* (= Phoenix Turtle) because of its close association with dense stands of Phoenix Palm (*Phoenix paludosa*), a common plant in freshwater wetlands.

Comments: THORBJARNARSON *ET AL.* (2000b) mistakenly speculated that *Thinbaung Leik* was the vernacular name applied to *Cuora amboinensis* in the Ayeyarwady Delta. Specimens of *H. grandis* from the Ayeyarwady Delta represent a significant range extension south-eastwards and westwards from populations reported in Bago Region and Mon State, respectively (THEOBALD, 1868; IVERSON, 1992). Specimens of *H. grandis* examined by PLATT *ET AL.* (2005) in Shwegu were being trans-shipped to buyers in southern China and almost certainly collected elsewhere.

Melanochelys trijuga edeniana (Burmese Black Turtle)

Sagaing Region: Plastron of adult female (PL = 200 mm; Fig. 9A) in Thanpaya (21 March 2014). Intact shell of juvenile (CL = 155 mm, PL = 141 mm, annuli = 7; Fig. 9B and C) in Htan Pin Gyaung (22 March 2014). Both turtles were captured in grass swamps known as *Khaing Daw*.

Folk knowledge: *Melanochelys trijuga edeniana* is known locally as *Leik Poke* (= Odorous Turtle), a name also applied to *Cyclemys fusca* (see above). *Melanochelys trijuga edeniana* are said to occur sympatrically in grass swamps with *C. amboinensis* (see above). Both *M. trijuga edeniana* and *C. amboinensis* are hunted by setting grass swamps afire during the dry season; turtles are captured either when moving away from the flames or picked up in the aftermath of the burn. Hunters also employ dogs to find both species in grass swamps. *Melanochelys trijuga edeniana* are occasionally found by hunters beneath large fig trees (*Ficus* spp.) consuming fallen fruit.

Comments: The distribution of *M. trijuga edeniana* within Myanmar remains ill-defined. The two specimens we examined constitute the second and third records from the Chindwin River basin (PLATT *ET AL.*, 2013). Additional records are available from the dry zone near Magway (PLATT *ET AL.*, 2001), Mandalay (IVERSON, 1992), and Toungoo (THEOBALD, 1868), along the Ayeyarwady between Mandalay and Bhamo (SMITH, 1931), “the Karenni foot-hills near Moulmein” (SMITH, 1931), and the Arakan (= Rakhine) Hills (THEOBALD, 1868; SMITH, 1931). Given the obvious geographic barriers (western mountains) to gene flow that isolate populations of *M. trijuga* in Myanmar from those in Bangladesh and India (IVERSON, 1992), we suggest the taxonomic status of *M. trijuga edeniana* warrants re-evaluation. A clutch of seven eggs was deposited by a captive female (CL = 260 mm, PL = 233 mm) at a chelonian rehabilitation facility in Bam Bwae on 20 November 2016. Mean ($\pm$ SD) length, width, and mass of the eggs were 54.7 ± 1.8 mm (range = 52 to 57 mm), 33.8 ± 2.2 mm (range 31 to 37 mm), and 37.1 ± 2.6 g (range 35 to 40 g), respectively. Our record appears to be the only report of clutch size and egg morphometry for *M. trijuga edeniana*. According to SMITH (1931), *M. trijuga edeniana* deposits a “number of oval eggs at one time”.

***Siebenrockiella crassicollis* (Black Marsh Turtle)**

Tanintharyi Region: Intact shell (CL = 143 mm, PL = 109 mm) in Ye Phyu from turtle harvested in nearby wetland (13 May 2012).

Folk knowledge: Hunters in Ye Phyu and other villages in southern Tanintharyi stated *S. crassicollis* are relatively abundant and inhabit the same heavily vegetated wetlands where Spiny Turtle (*Heosemys spinosa*) and *H. grandis* are found (sites described in PLATT *ET AL.*, 2014b).

Comments: We observed approximately 25 *S. crassicollis* in a pond at Shwe Dagon Pagoda (Myiek) suggesting these turtles are locally common.

Emydidae

***Trachemys scripta elegans* (Red-eared Slider)**

Yangon Region: Repeated observations of subadult and adult turtles (CL ca. 100–200 mm) basking on woody substrates in earthen pond associated with a Buddhist shrine (16°50'04"N; 96°07'04"E; altitude 20 m) in Hlaing (2015–2017). At least four large adults (CL ca. 200 to 250 mm) inhabit the pond, although evidence of reproduction has not yet been forthcoming.

Comments: Despite being widely available in the domestic pet trade and the most abundant turtle in pagoda ponds (SAN SAN WIN, 2005), we are unaware of any established feral populations of *T. scripta elegans* within Myanmar. This temperate zone chelonian may be unable to successfully reproduce under tropical conditions in Myanmar. More likely, failure to become established is due to predation of nests and hatchlings. House Crows (*Corvus*

splendens) which are extremely abundant in urban centers are likely to excavate nests and consume eggs, while hatchlings would seem to stand little chance of survival as most pagoda ponds also harbor large numbers of introduced African catfish (*Clarias gariepinus*), an omnivorous species known to feed on a variety of invertebrates and small vertebrates (MUNRO, 1967; DADEBO *ET AL.*, 2014).

Testudinidae

Geochelone platynota (Burmese Star Tortoise)

Sagaing Region: Two carapaces (CL = 140 and 145 mm, annuli = 5 and 8, respectively; Fig. 10) examined at Mile 34 Forest Camp (28 November 2013). Both tortoises reportedly harvested about 30 years ago from *Indaing* forest near Khin Myin (GPS coordinates unavailable; located ca. 21 km E–NE Mile 34 Forest Camp). According to our informants, *G. platynota* is no longer extant in this region.

Folk knowledge: According to widespread lore, the distributional limits of *G. platynota* within Myanmar are defined by the geographic range of the Jujuba Plum (*Ziziphus jujuba*).

Comments: *Geochelone platynota* is endemic to the dry zone of central Myanmar, an ill-defined desert-like region formed by the rain shadow of the western mountains (PLATT *ET AL.*, 2011). There are few specimen-based records for *G. platynota* and its distribution within this region remains poorly documented (PLATT *ET AL.*, 2011). Our two specimens represent the northernmost confirmed occurrence of *G. platynota* in the Chindwin River basin (PLATT *ET AL.* 2013), and are among the northernmost records in Myanmar (PLATT *ET AL.*, 2011). We discount the widespread idea concerning the respective distributional limits of *G. platynota* and *Z. jujuba*. Our observations indicate the geographic range of *Z. jujuba* is considerably more extensive than that of *G. platynota* and extends well beyond the dry zone. We instead suggest the distribution of *G. platynota* more closely approximates that of the Eld's Deer (*Cervus eldi*) in Myanmar (McSHEA *ET AL.*, 1999).

Manouria emys phayrei (Burmese Brown Tortoise)

Tanintharyi Region: Two adult males (CL = 475 and 363 mm) and two females (CL = 490 and 482 mm) examined in Maliwone (6 May 2012); reportedly captured nearby in evergreen forest. These tortoises were later incorporated into a captive-breeding colony. Carapace (CL = 405 mm) in Boke Pyin from tortoise collected in nearby forested hills (8 May 2012).

Folk knowledge: According to hunters, *M. emys phayrei* is restricted to intact evergreen forest and avoids secondary forest and oil palm plantations, even when a dense understory is present in the latter. Hunters in Tanintharyi report *M. emys phayrei* can often be found in dense forest by listening for their vocalizations. *Manouria emys phayrei* is sometimes captured in snares set along game trails for wild pigs (*Sus scrofa*) and sambar deer (*Cervus unicolor*). Hunters also find *M. emys phayrei* with the assistance of hunting dogs and others are opportunistically taken during land clearing operations. Captured tortoises are invariably butchered for domestic consumption. Villagers in Chaung Lamu consider the large body size attained by *M. emys phayrei* to be indicative of great age. Because killing an animal that has reached an advanced age is believed to anger the local *Nats* (Earth Spirits; see PLATT *ET AL.*, 2003b), villagers in Chaung Lamu generally refrain from killing large tortoises, in marked contrast to most communities where *M. emys phayrei* is readily consumed.

Comments: Perhaps the greatest threat to *M. emys phayrei* populations in Tanintharyi Region is widespread forest clearance for oil palm plantations (EAMES *ET AL.*, 2005), which continues unabated (PLATT *ET AL.*, 2012a). From a conservation standpoint it would be worth investigating the ubiquity of the beliefs expressed by villagers in Chaung Lamu and whether these beliefs can be harnessed for effective protection. Similar religious beliefs have been successfully incorporated into conservation programs for *Geochelone platynota* (PLATT *ET AL.*, 2014a) and this model is probably transferable to other species of threatened chelonians.

Trionychidae

Amyda cartilaginea (Asian Softshell Turtle)

Bago Region: Dried carapace (CL = 175 mm) from turtle captured in Zamari Chaung obtained from villagers in Zamari Chaung Camp (8 November 2016). **Chin State:** Carapace (CL = 178 mm) from turtle captured in Kaungbar Chaung, a swift-flowing mountain stream on outskirts of Matupi (5 November 2012). **Kayah State:** Adult female (CL = 420 mm) and dried carapace (CL = 174 mm) in possession of hunter, Hpasawng (21 April 2016). Juvenile (CL = 92 mm) in possession of hunter, Nam Mann (25 April 2016). Juvenile (CL = 92 mm, PL = 100 mm), Parpu (25 April 2016). **Sagaing Region:** Dried carapace (CL = 140 mm) from turtle captured in Chindwin River at Mya Sein Kyun (14 February 2012). Dried carapace (CL = 200 mm) from turtle captured in Nam Thalet Chaung at Nam Thalet Village (2 March 2012). Dried carapace (CL = 250 mm) at fishing camp on outskirts of Homalin from turtle captured in heavily vegetated floodplain wetland (14 March 2013). Carapace (CL = 146 mm) at Elephant Camp in Alaung Daw Kathapa National Park (18 November 2013). Adult male (CL = 488 mm) captured by fishermen on sandbank near Padumone (14 March 2015). Three turtles captured by fishermen in Chindwin River near Limpha (CL = 224 mm, PL = 169 mm; CL = 109 mm, PL = 83 mm; CL = 91 mm, PL = 78 mm) (13 February 2016). These three turtles were later obtained for captive-breeding group and injected with microchips; one turtle (CL = 91 mm) emitted a strong odor when microchip was injected.

Folk knowledge: *Amyda cartilaginea* is known by a confusing array of vernacular names that are sometimes applied to other species of softshell turtles; *Ohn Thi San Leik* (= “Coconut Pulp Turtle” because the meat is similar in taste to coconut), *Padi Leik* (= “Beaded Turtle” in reference to carapacial tubercles), *Si Cho Leik* (= “Oil Cup Turtle” so named because the dried carapace is used to dispense cooking oil), *Khabar Leik* (= “World Turtle”, an oblique reference to large body size, i.e. “as big as the world”; see also PLATT *ET AL.*, 2004), *Paung Taung Leik* (non-descriptive name of uncertain meaning), and *Anar Pyaw Leik* (= “Soft-margin” turtle, an obvious reference to soft margin of the carapace). *Amyda cartilaginea* is heavily exploited wherever it occurs in Myanmar; large turtles are sold to illegal wildlife traffickers, while smaller individuals are either sold or kept for domestic consumption. *Amyda cartilaginea* (and other softshell turtles) are captured on baited hooks or impaled on harpoons; the latter technique is only effective in minimally turbid water where buried turtles are visible in the substrate. Softshell turtles are also taken as by-catch in various fish traps and nets.

Comments: *Amyda cartilaginea* has not previously been reported from Kayah State or Sagaing Region in Myanmar (IVERSON, 1992; KUCHLING *ET AL.*, 2004; AULIYA *ET AL.*, 2016). Collectively our records and others (KUCHLING *ET AL.*, 2004; PLATT *ET AL.*, 2004; KUCHLING *ET AL.*, 2006; PLATT *ET AL.* 2012b, 2013, 2017b) indicate that in Myanmar, *A. cartilaginea* is a habitat generalist occurring in swift-flowing, rocky upland streams, and lowland rivers, lakes, and

swamps. The overwhelming consensus among villagers and fishermen is that *A. cartilaginea* and other softshell turtles (except *Lissemys scutata*) are becoming increasingly rare owing to over-harvesting. Indeed, softshell turtle populations have declined to such an extent that deliberate pursuit is no longer deemed economically worthwhile and most softshell turtles are harvested incidental to fishing. Genetic analyses by FRITZ *ET AL.* (2014) suggest that *A. cartilaginea* actually represents multiple taxonomic entities with those occurring in Myanmar designated as *Amyda ornata*. However, AULIYA *ET AL.* (2016) argue that further taxonomic readjustment is likely, given that key geographic areas were incompletely sampled, and they continue to treat *A. cartilaginea* as a single species pending a more thorough taxonomic revision. Nonetheless, the existence of distinct genetic entities argues for their specific recognition as a mechanism for legal protection of Asian Softshell Turtle populations.

***Chitra vandijki* (Burmese Narrow-headed Softshell Turtle)**

Bago Region: Adult (CL = 310 mm) obtained from fishermen after being captured in the Ayeyarwady River at Pyay; incorporated into captive-breeding colony (30 November 2017). **Sagaing Region:** Clutch of 56 eggs collected by villager from sandbank at Padumone and transferred to secure incubation area at a turtle rearing facility in Limpha on 25 August 2016. Mean ($\pm$ SD) egg mass and diameter were 13.6 ± 1.9 g (range 6.8–16.2 g) and 37.0 ± 1.0 mm (range 35.0–38.8 mm), respectively. Three eggs hatched on 14 November 2016.

Comments: KUCHLING *ET AL.* (2004) and PLATT *ET AL.* (2005) previously reported *C. vandijki* from the Chindwin and Ayeyarwady rivers, respectively. The turtle we obtained from the Ayeyarwady River at Pyay represents the southernmost record of *C. vandijki* in the Ayeyarwady-Chindwin River System (PLATT *ET AL.*, 2014c). Our observations presented here are apparently the first report of reproduction by *C. vandijki* (reviewed by PLATT *ET AL.*, 2014c). PLATT *ET AL.* (2014c) speculated that *C. vandijki* deposits clutches early in the dry season (November and December) with eggs hatching before the beginning of the wet season (May–June). Our observations suggest otherwise; eggs collected in late August indicate that nesting occurred during the mid-wet season and hatchlings emerged at the beginning of the dry season.

***Lissemys punctata* (Indian Flapshell Turtle)**

Rakhine State: Turtle (CL = 200 mm; Fig. 11) captured by villager in ricefield-wetland complex adjacent to Headquarters of Rakhine Yoma Elephant Sanctuary in Gwa (22 September 2013). Turtle (TL ca. 200 mm) found by farmer in flooded ricefield adjacent to Gone Gyi (8 July 2017).

Folk knowledge: Wildlife traders reportedly refuse to purchase *L. punctata* because the yellow blotches on carapace are believed to be symptomatic of disease. *Lissemys punctata* is known locally as *Pyauk Zin Shaw Leik* (= Spotted *Zin Shaw Leik*) because these turtles resemble *L. scutata* with spots (*Zin Shaw Leik* is the local name for *L. scutata*; see below).

Comments: We are unaware of any recent records of *L. punctata* from Myanmar. According to SMITH (1931), *L. punctata* occurs in northern Arakan (= Rakhine) State and off-shore islands on the western coast of Myanmar. *Lissemys punctata* is also known from Sittwe and Taung Gok (IVERSON, 1992). Our records of *L. punctata* are the southernmost yet reported in Myanmar and represent a range extension of ca. 130 km southwards from Taung Gok.

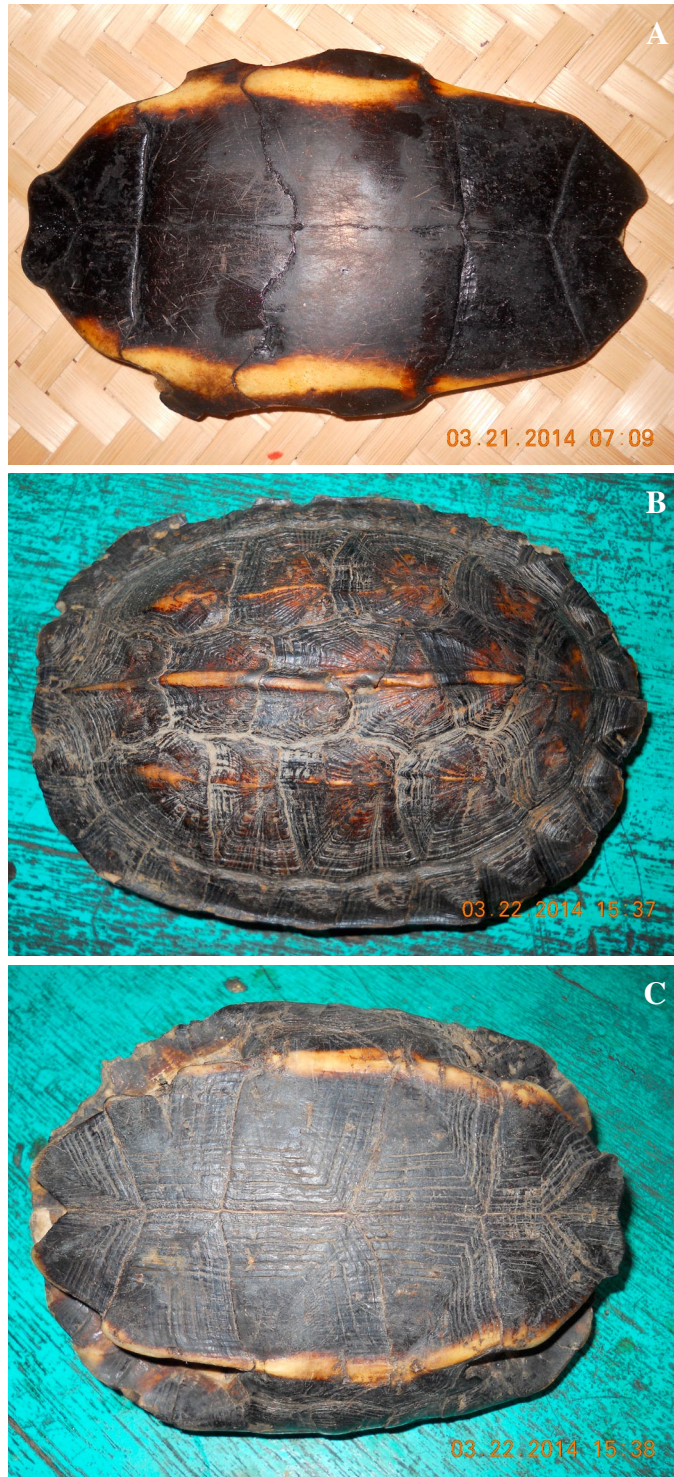


Figure 9. Burmese Black Turtle (*Melanochelys trijuga edeniana*) from Sagaing Region: Plastron from (A) Thanpaya (21 March 2014) and complete shell from (B and C) Htan Pin Gyaung (22 March 2014). Photographs by Steven G. Platt.



Figure 10. Carapaces of two Burmese Star Tortoise (*Geochelone platynota*) collected about 30 years ago and examined at Mile 34 Forest Camp, Sagaing Region (28 November 2013). The carapaces were bolted together and used as an ash tray. Photograph by Kalyar Platt.



Figure 11. Indian Flapshell Turtle (*Lissemys punctata*) found by villagers in ricefield-wetland complex adjacent to Headquarters of Rakhine Yoma Elephant Sanctuary, Rakhine State (22 September 2013). Photograph by Win Ko Ko.

Lissemys scutata (Burmese Flapshell Turtle)

Ayeyarwady Region: Juvenile (CL = 110 mm) in Kone Pyin (15 May 2010); found buried while villager was plowing a dry rice field about three days prior to our visit. Four large adults observed in natural pond in Myanaung, and two round, hard-shelled eggs (egg diameters 24 and 25 mm) found in shallow hole excavated in dry, compacted soil along the shore (16 January 2017). A second nest was found adjacent to heavily vegetated natural wetland in Kanaung (17 January 2017). This nest was excavated in hard clay soil at base of small tree (diameter ca. 380 mm) about 3 m from water, and contained four eggs (diameters 23, 23, 24, 25 mm) loosely covered with ground debris (leaves and loose soil). Local resident stated the clutch was deposited in mid-December 2016. **Magway Region:** Large number of turtles (35–40) in natural pond (20°17'23"N; 94°29'41"E; altitude 225 m) on grounds of monastery near summit of Mya Kyaune Taung (8 September 2011). Two turtles (CL ca. 200 mm) observed in roadside ditch draining rice fields and wetlands in floodplain of Mon Chaung at Soe Taw (8 September 2011). **Mandalay Region:** Living turtle (CL = 155 mm) and dried carapace (CL = 145 mm) examined in See Ma on the lower slopes of Mount Popa (22 June 2010). The living turtle was captured in a permanent stream while dried carapace came from a turtle captured in seasonal waterbody; both capture sites were located in lowlands below village. Four or five turtles (CL ca. 150–200 mm) observed in seasonal pond used as village water source at Mya Taung (19 September 2011). Two hatchlings (CL = 59 and 57 mm) captured at a seasonal pond in Bagan Archaeological Site in Bagan (21 September 2012). Dried carapace (CL = 161 mm) in Yeh Naung U (10 December 2014). Turtle captured in extensive anthropogenic marsh formed where Kin Chaung, heavily laden with sediments from upstream mining activities, debouches from Shan Plateau onto Ayeyarwady Floodplain. Carapace (CL = 140 mm) in Nat Hmaw Oo (5 November 2015). Four adults (CL ca. 150–250 mm) and three or four small juveniles (CL ca. 50 mm) observed in two natural ponds on grounds of monastery on Min Pan Taung (10 November 2015); one pond was filled with aquatic vegetation and surrounded by secondary forest while the other had little vegetative cover. Some turtles undoubtedly released into the ponds by religious pilgrims, although others probably immigrated from nearby wetlands. A resident monk stated that each year the turtles construct nests in bare, hard-packed soil about 10 m from edge of pond. Turtle (CL = 130 mm) found moving through open grassland ca. 1.0 km from nearest waterbody at Minzontaung Wildlife Sanctuary (14 June 2016). **Sagaing Region:** Three to five adult turtles observed in small livestock pond (ca. 0.5 ha) in degraded deciduous forest and scrub at Hman Taung (8 November 2013).

Folk knowledge: Informants in Wet Toe stated *L. scutata* deposits a clutch of 7–9 eggs from October to December and hatchlings emerge in June. A hunter near Shwe Settaw Wildlife Sanctuary stated wild pigs (*Sus scrofa*) often enter shallow, drying ponds and prey on *L. scutata*. Wild pigs are also reportedly able to capture free-swimming *L. scutata* underwater; aestivating turtles are excavated when semi-dormant in the mud. As with other softshell turtles, a variety of hunting strategies are employed to capture *L. scutata*, including baited hooks and traps. *Lissemys scutata* are frequently taken as fisheries by-catch. Traps designed to specifically target *L. scutata* are bamboo cylinders, about 1.0 m long, of varying diameter with a funnel-shaped opening. Various baits are used including chicken entrails, small fish, and roasted cow skin and pork; roasting is thought to enhance the odiferous properties of the bait. *Lissemys scutata* are also taken by hand during the dry season when wetlands are reduced to a series of shallow pools.

Comments: Our observations appear to be the first descriptions of nests, eggs, and reproductive phenology of *L. scutata*. Virtually nothing else is known concerning the reproductive ecology of *L. scutata* other than a brief paragraph in SMITH (1931; as *L. punctata scutata*), which states females deposit eggs (about 25 mm in diameter) in December and bury the clutch in mud. Collectively our observations indicate *L. scutata* inhabits a variety of alluvial and non-alluvial freshwater wetlands, but is most frequently reported from seasonal water bodies, often within densely populated agricultural areas.

Nilssonia formosa (Burmese Peacock Softshell Turtle)

Sagaing Region: Fresh carapace (CL = 154 mm) of turtle captured in the Chindwin River at Thanthar (2 February 2013). Four turtles captured by fishers in the Chindwin River near Limpha (12 February 2016); sample included one female (CL = 308 mm, PL = 217 mm), and three juveniles (CL = 187 mm, PL = 142 mm; CL = 138 mm, PL = 102 mm; CL = 95 mm, PL = 74 mm; Fig. 12A). The ocelli of smaller two turtles (CL = 138 and 95 mm) were fringed with orange as reported by PLATT *ET AL.* (2016) for neonate *N. formosa*. The ocelli of intermediate-sized juvenile (CL = 187 mm) with distinct edges but orange coloration absent. Female (CL = 260 mm, PL = 196 mm) captured by road-workers in Nam Pelin Chaung at Chaung Wa (10 March 2016). Juvenile (CL = 130 mm, PL = 100 mm; Fig. 12B) captured by villagers in Nam Pelin Chaung at Chaung Wa (23 March 2016). A recently deposited clutch of 34 eggs excavated from sandbank at Padumone was purchased in a local market on 4 December 2016. Mean ($\pm$ SD) egg mass and diameter were 30.3 ± 2.4 g (range 23.9–34.2 g) and 37.0 ± 1.0 mm (range 35.0–38.8 mm), respectively. Eggs were incubated in a Styrofoam box at ambient temperatures and began hatching on 20 July 2017 after an incubation period of at least 229 days.

Folk knowledge: Like *A. cartilaginea*, a confusing array of vernacular names is applied to *N. formosa*. Along the Chindwin River *N. formosa* is known as *Lay Kwet Leik* (= “Turtle with four blotches”; a reference to carapacial ocelli), *Sei Kwet Leik* (= “Turtle with four blotches”; mixture of Shan and Burmese), and *Shan Gyi Liek Maung* (= “Large Shan Arm Turtle”; Burmese name is an oblique reference to the pattern of skin coloration which resembles tattoos worn on the biceps of Shan men; this name is also applied to *Chitra vandijki*). Along the Ayeyarwady River, *N. formosa* is known as *Khabar Leik* (see *A. cartilaginea* above), *Can Gyi Leik* (= “Big-headed Turtle”), *Kyi Leik* (= “Star Turtle”; reference to carapacial ocelli), and *Si Cho Leik* (see *A. cartilaginea*).

Nilssonia formosa is actively sought by fishermen for domestic consumption and sale to illicit wildlife traders. Turtles are harvested using the same strategies as for *A. cartilaginea* (see above). Fishermen along the Ayeyarwady River reported finding small fish (*Cabdio morar*) in the stomachs of *N. formosa*. According to fishermen along the Chindwin River, females deposit 20–25 eggs during March and April that hatch in May and June. Nests are found on steep-sided sandbanks and occasionally in seasonal agricultural fields on riverbanks and sandbars. Eggs are prepared by boiling whole or opening and then frying the contents.

Comments: We noted a variable number of carapacial ocelli among the six turtles examined during March 2016: four turtles exhibited four ocelli, and one turtle each had five and eight ocelli. Similar variation was reported by PLATT *ET AL.* (2016) among 14 neonates from a single clutch. Our observations contrast markedly with earlier accounts (GRAY, 1869; SMITH, 1931) that describe *N. formosa* as having four dark centered ocelli on the carapace. An ailing

N. formosa that we measured (CL = 620 mm) on 14 January 2017 in a pond at Con Lay Shwe Pagoda in Pyay (Bago Region) exceeds the previously reported maximum carapace length of 380 mm (SMITH, 1931) and 490–570 mm (PRITCHARD, 2001). Our observations are apparently the first report of clutch size, egg characteristics, and nesting phenology for *N. formosa*. The lengthy incubation period we noted suggests embryonic diapause occurs during incubation. Populations of *N. formosa* are probably declining as a result of sustained over-harvesting for domestic consumption and commercial sale (see comments for *A. cartilaginea*).

SNAKES

Pythonidae

Python reticulatus (Reticulated Python)

Rakhine State: Adult (TL ca. 3,000 mm; Fig. 13) found in evergreen forest on high ridge (altitude = 324 m) above Kyauk Moe Kho Basecamp in Rakhine Yoma Elephant Sanctuary (31 May 2013). **Tanintharyi Region:** Juvenile (TL ca. 1,200 mm) in deep pool near mouth of freshwater creek on Wah Ale Beach (10°50'43"N; 98°04'25"E; altitude 1 m) on Wah Ale in Lampi Marine National Park (19 November 2015). Habitat adjacent to the creek consisted of mangroves and evergreen tropical forest

Comments: To our knowledge, *P. reticulatus* has not previously been reported from Lampi Island; however, the presence of this species is not unexpected given its widespread occurrence on islands in the region (DAS, 2010) and abundance in forests of southern Tanintharyi (G. Zug, unpubl. data).

Python bivittatus (Indian Rock Python)

Rakhine State: Adult (TL ca. 2,500 mm) among boulders in tributary creek of Kyentali Chaung at Kyen Khar Kone Basecamp (1 June 2009). Habitat adjacent to creek was dense bamboo brakes on steep slopes. **Mandalay Region:** Snake (TL ca. 2,000 mm) in residence on pagoda grounds in Six Mile Village (9 December 2014); surrounding habitat was cut-over deciduous forest and agricultural land. **Sagaing Region:** Snake (TL ca. 1,500 mm) swimming across Chindwin River (1920 hrs) at Kauk Thauang (20 February 2012).

Comments: Although general accounts suggest *P. bivittatus* is widely distributed within Myanmar (e.g. COX *ET AL.*, 2010; DAS, 2010), few published observations or museum specimens are available for the country (BARKER & BARKER, 2008). Furthermore, fewer than six *P. bivittatus* were found during extensive surveys (1997–2010) of numerous wildlife and forest reserves by the Myanmar Herpetology Survey (G. ZUG, unpubl. data).

Colubridae

Ahaetulla nasuta (Green Vine Snake)

Mandalay Region: Snake (TL ca. 700 mm) observed (1930 h) among dense vegetation near Lawkanandar Pagoda, Bagan (26 November 2012). Snake appeared to be hunting the numerous geckos (Gekkonidae) present on pagoda walls.

Comments: Although general accounts (COX *ET AL.*, 2010; DAS, 2010) suggest the diet consists of tadpoles, lizards, birds and small mammals, we are unaware of any empirical reports describing specific prey consumed by *A. nasuta*.

***Coelognathus radiatus* (Copper-head Trinket Snake)**

Sagaing Region: Adult (CL ca. 1,600 mm) encountered (1805 hr) on sandbank along Chindwin River at Limpha (7 March 2016). Snake traversed about 100 m of open sandbank, entered the water, and swam across the Chindwin River. Riverside habitat was mosaic of fallow swidden fields and evergreen forest.

Comments: Our observation suggests large rivers are not barriers to dispersal.

***Chrysopelea ornata* (Golden Tree Snake)**

Ayeyarwady Region: Snake (TL ca. 800 mm) in dense vegetation along urban drainage canal in Nwe Saung (29 June 2014).

***Dendrelaphis pictus* (Common Bronzeback)**

Bago Region: Small snake (TL ca. 300 mm) in bamboo brake in deciduous forest about 1 km W Mile 24 Camp, North Zamari Wildlife Sanctuary (18 November 2016). **Rakhine State:** Adult (TL ca. 450 mm) observed moving rapidly through dense understory of evergreen forest near Ozzie Basecamp (27 May 2013). **Sagaing Region:** Badly damaged carcass (not measured) found on road in Naung Pin (9 March 2013). Site was within village with patches of low scrub. Adult male (TL = 1,150 mm, SVL = 795 mm) DOR in tea plantation with forest overstory on outskirts of Htamanthi (26 March 2017).

***Lycodon aulicus* (Common Wolf Snake)**

Sagaing Region: Adult (TL ca. 400 mm; 1930 hr) on bare ground in schoolyard at Nga Ohn (21 March 2014). Surrounding habitat consisted of fallow ricefields, degraded dry forest, and scrub.

***Oligodon splendidus* (Splendid Kukri Snake)**

Mandalay Region: Badly damaged carcass (TL = 640 mm; Fig. 14) recovered after being killed by workers in out-building at Minzontaung Wildlife Sanctuary Headquarters (13 November 2013). Habitat surrounding headquarters is dense thorn-scrub forest with grass understory; described in greater detail by PLATT *ET AL.* (2003c).

***Ptyas korros* (Javan Rat Snake)**

Mandalay Region: Adult (TL ca. 1,000 mm) encountered on lawn at Myanmar Forestry School in Pyin Oo Lwin (14 November 2014). **Sagaing Region:** Adult (TL ca. 1,500 mm) killed by villagers (1300 h) when discovered in outbuilding in Kyun Daw (23 March 2014). Habitat surrounding the village was scrub, ricefields, and open wetlands along Maukaw Daw Chaung.

Folk knowledge: According to villagers in Kyun Daw, the bite of *P. korros* is toxic to humans and livestock. When a person is bitten, the “venom” is thought to flow to the head. If the head is left uncovered, the “venom” is said to diffuse through the skin and vaporize, causing the victim no lasting harm. Therefore, treatment for the bite of this non-venomous serpent consists of leaving the head uncovered. No treatment is administered when livestock are bitten. The local name for *P. korros* is *Lem Mway*.



Figure 12. Burmese Peacock Softshell Turtles (*Nilssonia formosa*) captured in (A) Chindwin River (12 February 2016) and (B) Nam Pelin Chaung (23 March 2016) in Sagaing Region. Note variable number of carapacial ocelli. Photographs by Steven G. Platt.



Figure 13. Reticulated Python (*Python reticulatus*) found in evergreen forest above Kyauk Moe Kho Basecamp in Rakhine Yoma Elephant Sanctuary, Rakhine State (31 May 2013). Photograph by Steven G. Platt.



Figure 14. Splendid Kukri Snake (*Oligodon splendidus*) killed by workers at headquarters of Minzontaung Wildlife Sanctuary, Mandalay Region (13 November 2013). Photograph by Khin Myo Myo.

Viperidae

Trimeresurus erythrurus (Spot-tailed Pitviper)

Rakhine State: Badly damaged carcass of female (not measured) found on a heavily trodden footpath through riparian forest in landscape of fallow ricefields and scrub vegetation on the outskirts of Ya Haing Phyar (24 May 2013).

Comments: Previously reported from Rakhine State (LEVITON *ET AL.*, 2008).

Trimeresurus cf. popeiorum (Pope's Tree Pitviper)

Tanintharyi Region: Snake (TL ca. 350 mm) coiled in trailside vegetation (ca. 45 cm above-ground) in undisturbed tropical evergreen forest on ridgeline (10°54'47"N; 98°13'15"E; altitude 228 m) above Me Gyaung Chaung in Lampi Marine National Park (14 December 2013).

Comments: Present on mainland of Tanintharyi Region (LEVITON *ET AL.*, 2008), but not previously reported from Lampi Island (BEFFASTI & GALANTI, 2011). The population of *T. popeiorum* in Tanintharyi Region probably represents an undescribed species (MULCAHY *ET AL.*, 2017).

Viridovipera grumprehti (Grumprecht's Pit Viper)

Sagaing Region: Adult (TL ca. 500 mm) found beneath a woodpile in Chaung Wa (12 March 2016). Habitat surrounding the village is a mosaic of small agricultural fields, second-growth forest, and undisturbed evergreen forest.

Comments: Not previously reported for Sagaing Region, but present in adjacent Chin State and southern Kachin State (LEVITON *ET AL.*, 2008).

Daboia siamensis (Eastern Russell's Viper)

Mandalay Region: Adult (TL ca. 900 mm) encountered in scrub forest and grass on lower slopes of Minzon Taung (= mountain) at Minzontaung Wildlife Sanctuary (MWS; 24 September 2014). Adult (TL = 965 mm) killed (2200 hr) near headquarters of MWS (6 April 2015). Adult (TL ca. 1,000 mm) found in captive-breeding colony of *Geochelone platynota* at headquarters of MWS (24 May 2017). MWS is characterized by thorn scrub forest with abundant leaf litter and in some areas, dense grass understory (described in greater detail by PLATT *ET AL.*, 2003b).

Comments: MWS staff regard *D. siamensis* as abundant within the sanctuary and report frequent encounters. Previously reported from Mandalay Region by LEVITON *ET AL.* (2008).

Cylindrophiiidae

Cylindrophis burmanus (Burmese Pipe-snake)

Bago Region: Badly damaged specimen (TL ca. 250 mm; Fig. 15) DOR on Minhla to Myo Chaung Road at Mile 24 Camp in North Zamari Wildlife Sanctuary (18 November 2016). Habitat adjacent to road was young teak (*Tectona grandis*) plantation with dense herbaceous understory.

Comments: Although occurring widely in Myanmar, to our knowledge *Cylindrophis burmanus* has not previously been reported from Bago Yoma Hills (AMARASINGHE *ET AL.*, 2015).

Elapidae

Bungarus fasciatus (Banded Krait)

Rakhine State: Adult (TL = 1,180 mm, SVL = 970 mm, stomach empty) found dead in small creek in evergreen forest surrounding Kanyin Gyauk Basecamp (29 May 2013). Carcass fresh, but partially consumed by freshwater crabs; snake may have been killed by Crested Serpent Eagle (*Spilornis cheela*) observed nearby. **Tanintharyi Region:** Dead female (TL = 1,180 mm; SVL = 1,070 mm; Fig. 16) entangled in monofilament fishing net deployed in ricefield irrigation ditch adjacent to second-growth evergreen forest on outskirts of Shan Inn Daw (13 May 2012).

Comments: Not previously reported from Tanintharyi Region (LEVITON *ET AL.*, 2008).

Bungarus magnimaculatus (Splendid Krait)

Sagaing Region: Adult (TL ca. 1,000 mm; Fig. 17) swimming in pond on grounds of Taw Ya Gyi Pagoda (5 November 2015); surrounding habitat is second-growth deciduous forest.

Comments: Rarely encountered species endemic to central and northern Myanmar; previously reported from Sagaing Region (SMITH, 1943; LEVITON *ET AL.*, 2008).

Naja kaouthia (Monocled Cobra)

Ayeyarwady Region: Snake (TL = 1,120 mm; SVL = 1,060 mm; sex = female) killed by farmer in fallow ricefield at Duyar In (19 January 2017).

Comments: Previously reported from Ayeyarwady Region (LEVITON *ET AL.*, 2008).

Naja mandalayensis (Mandalay Cobra)

Magway Region: Large adult (TL ca. 1,800 mm) in scrub deciduous forest with abundant bamboo (*Dendrocalamus strictus*) and scattered agricultural fields in buffer zone of Shwe Settaw Wildlife Sanctuary (24 June 2015). Snake first encountered in scrub on edge of fallow agricultural field (20°03'36"N; 94°35'51"E); rapidly retreated into dense bamboo clump and climbed >2.5 m above-ground. Numerous fresh earthen mounds made by bamboo rats (*Rhizomys* sp.) at site of observation, although there was nothing to indicate the snake was hunting these rodents.

Comments: Previously reported from dry forest in Magway Region (LEVITON *ET AL.*, 2008).

Ophiophagus hannah (King Cobra)

Magway Region: Two farmers with a decapitated gravid female (TL = 2,820 mm; SVL = 2,340 mm; head missing; Fig. 18A) containing 21 eggs (length 73 mm; width 33 mm; n = 1; Fig. 18B) killed while clearing swidden fields in secondary forest near Khu Chaung (27 May 2011). Other villages stated *O. hannah* are frequently encountered in forests and scrub surrounding Khu Chaung. Adult (TL ca. 3,000 mm) photographed near tortoise reintroduction pens (20°11'43"N; 94°30'29"E) in deciduous forest with dense grass understory at Shwe Settaw Wildlife Sanctuary (8 June 2017).

Folk knowledge: Owing to the danger these snakes pose to humans and livestock, *O. hannah* are generally killed whenever encountered. These snakes are often found by dogs and then killed with stand-off weapons such as slingshots (catapults) or muzzle-loading black powder



Figure 15. Badly damaged DOR specimen of Burmese Pipe-snake (*Cylindrophis burmanus*) found in North Zamari Wildlife Sanctuary of Bago Yoma Hills, Bago Region (18 November 2016). Photograph by Steven G. Platt.



Figure 16. Banded Krait (*Bungarus fasciatus*) that drowned after becoming entangled in monofilament fishing net in a ricefield irrigation ditch near Shan Inn Daw, Tanintharyi Region (13 May 2012). Photograph by Steven G. Platt.



Figure 17. Splendid Krait (*Bungarus magnimaculatus*) encountered swimming in pond on grounds of Taw Ya Gyi Pagoda, Sagaing Region (5 November 2015). Photograph by Steven G. Platt.



Figure 18. (A) Gravid female King Cobra (*Ophiophagus hannah*) decapitated by farmers while clearing swidden fields near Khu Chaung, Magway Region (27 May 2011). (B) The snake contained 21 eggs which were removed and eaten by villagers. Photographs by Lewis R. Medlock.

firearms that minimize risk to the hunter. *Ophiophagus hannah* are occasionally consumed by rural villagers. The snake we examined in Khu Chaung was eaten by villagers after being lightly roasted over a small fire and then eviscerated with a lengthwise slit along the venter. The kidney was discarded as this organ is thought to be toxic; the other organs were washed and then boiled or roasted. The gall bladder was impaled on a bamboo sliver for drying; the dried organ is considered a potent treatment for malaria when consumed with alcohol. Scales were then scraped from the lightly roasted carcass, which was manually broken into pieces (15–20 cm long). Except for evisceration, villagers avoid using knives for butchering venomous snakes because rust is considered toxic as is cobra venom; thus, allowing rust to contact snake meat is believed to be dangerous and can render the meat unfit for human consumption. The meat was mixed with vegetables, stewed until tender, and served as an oily curry. The clutch of eggs removed from the carcass was cooked together with the meat.

Comments: *Ophiophagus hannah* has not previously been reported from Magway Region, but is known from adjacent Mandalay Region (LEVITON *ET AL.*, 2008). The clutch size of the decapitated snake we examined in Khu Chaung is near the minimum range (20 to 51 eggs) given by DAS (2010) for *O. hannah*. *Ophiophagus hannah* once figured prominently in the cobra-worshipping cults of Myanmar, but these practices apparently no longer continue and remain poorly understood (PLATT *ET AL.*, 2012c).

***Laticauda colubrina* (Yellow-lipped Sea Krait)**

Ayeyarwady Region: Snake (TL ca. 1,000 mm; Fig. 19) found at surf line on open sandy beach at Nwe Saung (29 June 2014).

Folk knowledge: Fishermen setting nets a short distance (ca. 100 m) offshore from New Saung Beach reported occasionally taking sea snakes (presumably including *L. colubrina*) as by-catch. Sea snakes are recognized as venomous and generally killed before being removed from nets. Given the intensity of local fishing pressure, this incidental by-catch could represent an important source of mortality for sea snakes.

Comments: SMITH (1943) states *L. colubrina* is uncommon in the Indian Ocean. MINTON (1975) considered *L. colubrina* rare in the Bay of Bengal, but speculates this species may be more common along the western coast of Myanmar. Our observation is the first report of *L. colubrina* from Ayeyarwady Region (LEVITON *ET AL.*, 2008).

***Hydrophis cyanocinctus* (Annulated Sea Snake)**

Ayeyarwady Region: Snake (TL ca. 750 mm; Fig. 20) on mudbank exposed by falling tide (1620 hr) at Polaung Lay Camp in Meinmhlā Kyun Wildlife Sanctuary (27 January 2017). Snake unsuccessfully attempted to capture one of the numerous mudskippers (Oxudercidae) present on the mudbank, then entered a crab burrow, disappeared from view, emerged about 10 minutes later, and continued moving down the mudbank.

Comments: Our observation is the first report of *H. cyanocinctus* from Ayeyarwady Region; previously confirmed from Tanintharyi Region (LEVITON *ET AL.*, 2008). Our observations of foraging behavior are consistent with studies that report the diet of *H. cyanocinctus* consists largely of vermiform fish and marine invertebrates (KARTHIKEYAN *ET AL.*, 2008; REZAIIE-ATAGHOLIPOUR *ET AL.*, 2013).

Lamprophiidae

Psammodynastes pulverulentus (Mock Viper)

Bago Region: Juvenile (TL ca. 300 mm; Fig. 21) crossing dirt track along ridgeline ca. 200 m E of Nga Pwae Gyi (5 November 2016). Surrounding habitat was dense secondary forest and young teak plantation.

Folk knowledge: This snake is considered extremely venomous by local guides most likely due to its viper-like defensive stance when alarmed.

Comments: Not previously reported from northern Bago Yoma Hills (MILLER & ZUG, 2016).

Natricidae

Rhabdophis subminatus (Red-necked Keelback)

Chin State: Badly damaged DOR snake (TL = 450 mm) at an altitude of 2194 m along the Mindat-Matupi Road, 3.6 km west of Mindat (3 November 2012). Habitat adjacent to road was mixed evergreen and oak (*Quercus* spp.) forest with a dense understory of *Rhododendron*.

Sagaing Region: Adult (TL ca. 750 mm) encountered in spring-fed wet meadow ca. 1.6 km W of Htamanthi (28 February 2015). The distress calls of a ranid frog alerted us to the presence of this snake. The frog was being held cross-wise by the rear legs; the snake rapidly worked its jaws over the rear legs, and swallowed the frog, legs first, less than 60 seconds after being detected by us, before moving off rapidly into cover. **Shan State:** Adult (TL ca. 1,000 mm) basking on trail (22°58'29"N; 96°15'07"E; altitude 862 m) leading to summit of Hna Mataw Gyi in Shwe U Daung Wildlife Sanctuary (17 December 2014). Trailside habitat mixed deciduous forest and bamboo adjacent to recently abandoned *taungya* field.

Comments: Our record from Chin State is considerably higher than the published upper elevational limit of 1780 m (COX *ET AL.*, 2010; DAS, 2010).

Xenochrophis piscator (Chequered Keelback Water Snake)

Mandalay Region: Small snake (TL ca. 400 mm) ingesting a living catfish (Siluriformes; TL ca. 30 mm) among flotsam on bank of Ayeyarwady River at Shwe Hlay (12 November 2015). Three adults (TL ca. 500–900 mm) with Tilapia in drying pond among ricefields at Shwe Hlay (12 November 2015). One snake was swallowing the head of the fish, while another snake firmly held the dorsum of the fish in its jaws. A third snake was unsuccessfully attempting to gain a purchase on the anterior dorsum of fish between the other two snakes. Our efforts to photograph the group caused the three snakes to flee; the snake that had partly swallowed the head was the last to exit the site. **Sagaing Region:** Adult (TL ca. 500 mm) encountered among flooded vegetation in spring-fed side channel of Maukaw Daw Chaung at Kyun Daw (23 March 2014). Adult (TL ca. 600 mm) encountered at dusk (1745 hr) on roadside in close proximity to ricefields in Ye Mar Pin (16 November 2014). **Yangon Region:** Adult (TL ca. 700 mm) crossing road in area of ricefields and wet grassland, Hlaing (15 September 2013). Snake (TL ca. 500 mm) among debris along urban ditchbank, Aye Yeik Mon Housing Development, Hlaing (17 June 2016). Snake (TL ca. 900 mm) foraging in urban canal, Aye Yeik Mon Housing Development, Hlaing (20 June 2016).

Comments: Little specific information is available on the diet of *X. piscator*, although general accounts suggest fish, frogs, and other small vertebrates comprise a major portion



Figure 19. Yellow-lipped Sea Krait (*Laticauda colubrina*) found at surf line on open sand beach at Nwe Saung, Ayeyarwady Region (29 June 2014). Photograph by Steven G. Platt.



Figure 20. Annulated Sea Snake (*Hydrophis cyanocinctus*) entering crab burrow on mudbank exposed by falling tide (1620 hr) at Polaung Lay Camp in Meinmahla Kyun Wildlife Sanctuary, Ayeyarwady Region (27 January 2017). Earlier the snake was observed attempting to capture mudskippers. Photograph by Steven G. Platt.



Figure 21. Mock Viper (*Psammodynastes pulverulentus*) crossing dirt track near Nga Pwae Gyi in Bago Yoma Hills, Bago Region (5 November 2016). Photograph by Steven G. Platt.



Figure 22. One of three Spotted Keelback Water Snakes (*Xenochrophis punctulatus*) encountered (1040-1050 hr) on footpath between boat landing and Myauk Tayar Pagoda in Meinmahla Wildlife Sanctuary, Ayeyarwady Region (26 January 2017). Photograph by Steven G. Platt.

of the diet (COX *ET AL.*, 2010; CHAN-ARD *ET AL.*, 2015). BROOKS *ET AL.* (2009) found the diet of *X. piscator* in Tonle Sap, Cambodia was composed of both fish and anurans. Stable isotope analysis suggests *X. piscator* functions as an apex predator in aquatic food webs of northern Thailand (KUPFER *ET AL.*, 2016). Our observation of intraspecific kleptoparasitism appears to be the first report of this behavior in *X. piscator*.

***Xenochrophis punctulatus* (Spotted Keelback Water Snake)**

Ayeyarwady Region: Three snakes (TL ca. 500–700 mm; Fig. 22) encountered (1040–1050 h) on footpath between boat landing and Myauk Tayar Pagoda in Meinmahla Wildlife Sanctuary (26 January 2017). Footpath was constructed atop an elevated berm running through a dense stand of mangrove and freshwater swamp forest. Snakes appeared to be basking in patches of sunlight along the trail. Upon our approach, one snake immediately sought refuge in a crab burrow. Another snake reared its head about 200 mm off the ground in an apparent defensive stance; the anterior-most portion of the body was near vertical, while the head was held horizontally with a slight flaring of the body noted around the base of the head.

Comments: Also reported from Mwe Hauk in the Ayeyarwady Delta (G. ZUG, unpubl. data). CHAN-ARD *ET AL.*, (2015) states the preferred habitat of *X. punctulatus* is mixed deciduous forest, which is inconsistent with our observations in swamp forests of Ayeyarwady Delta. The global distribution of *X. punctulatus* remains poorly understood and requires further investigation for adequate resolution. *Xenochrophis punctulatus* also reportedly occurs in Assam, India (DAS, 2010) and northeastern Thailand (CHAN-ARD *ET AL.*, 2015).

LIZARDS

Agamidae

***Calotes mystaceus* (Blue Forest Lizard)**

Sagaing Region: Adult in canopy of large tree at headquarters of Htamanthi Wildlife Sanctuary, Homalin (16 March 2014). Riparian scrub along Chindwin River at Limpha (13 March 2016). Two adults in canopy of tree, Limpha (7 March 2017). Two adults in second-growth forest on outskirts of Htamanthi (14 March 2017). **Yangon Region:** Badly damaged DOR adult in urban area with some open land in Hlaing (22 July 2013).

***Calotes “versicolor”* (Variable Garden Lizard)**

Rakhine State: Three adults observed at different locations in evergreen forest and bamboo brakes near Ozzie Basecamp in Rakhine Yoma Elephant Sanctuary (26 May 2013). Two adults in secondary scrub on grounds of Rakhine Yoma Elephant Sanctuary Headquarters in Gwa (23 June 2017).

Comments: *Calotes versicolor* is a species of Variable Garden Lizard that occurs in southern India but not in Myanmar, hence the quotation marks around the specific name for Burmese populations (ZUG *ET AL.*, 2006; fide GOWANDE *ET AL.*, 2016). The central and northern Myanmar populations of the Variable Garden Lizard have been named, but southern populations (e.g. Rakhine State) are considered a different species from the former, and at the time of this writing lack a specific name.

Gekkonidae

Gekko gecko (Tokay)

Unless otherwise stated, our field records for *Gekko gecko* are based on vocalizations. **Ayeyarwady Region:** Farm buildings amidst coconut grove on outskirts of Ngwe Saung (29 December 2014). Urban area of Myanaung along Ayeyarwady River (16 January 2017). Police Station in Kanaung (17 January 2017). **Bago Region:** Second-growth forest adjacent to Nga Pwae Gyi (2 November 2016). Numerous vocalizing Tokay in mixed deciduous-evergreen forest to east and west of Zamari Chaung Camp (9–12 November 2016). **Chin State:** Village dwellings in Delong Kone (8 November 2012). Standing dead trees in abandoned *taungya* fields at Upper Pai (9 November 2012). Village dwellings in Sendi Taung (10 November 2012). Riparian evergreen forest adjacent to Kyet Chaung (11 November 2012). Standing dead trees in *taungya* fields and village dwellings at Sami (12 November 2012). Urban area of Paletwa (13 November 2012). Standing dead trees in abandoned *taungya* fields at Mi Gyaung Ba Wa (17 November 2012). Secondary forest surrounding Soe Nay Kanaung (18 November 2012). Secondary forest and village dwellings at Kone Pan (21 November 2012). **Magway Region:** Adult (TL ca. 200 mm) in headquarters buildings at Shwe Settaw Wildlife Sanctuary (15 June 2015). Adult (TL ca. 200 mm; Fig. 23A) in outbuilding at headquarters of Shwe Settaw Wildlife Sanctuary (17 October 2015). **Rakhine State:** Headquarters buildings of Rakhine Yoma Elephant Sanctuary, Gwa (23 May 2013). Village dwellings in Ya Haing Phyar (24 May 2013). Evergreen forest surrounding Ozzie Basecamp (25 May 2013). At least five Tokay vocalizing in urban habitat, Gwa (23 June 2017). **Sagaing Region:** Riparian forest in wetlands on outskirts of Homalin (16 March 2014). Urban dwelling in Kalaywa (17 March 2014). Village outbuildings in Kyaukke (18 March 2014). Guest house in Kalay (19 March 2014). Village residence in Kywe (20 March 2014). Several Tokay vocalizing simultaneously from houses and sugar palms (*Borassus flabellifer*) in Nga Ohn (21 March 2014). **Tanintharyi Region:** Headquarters building of Lampi Marine National Park in Boke Pyin (10 December 2013). Evergreen forest approximately 0.5 km E of Ma Kyone Galet on Bo Cho Island in LMNP (19 December 2013). Vocalizing Tokay in beach forest on Wah Ale Kyun in LMNP (20 November 2015). **Yangon Region:** Vacant lot with palm trees adjacent to International School of Myanmar in urban area of Hlaing Township (29 September 2012). House in urban area near Main Market in Hlaing Township (27 October 2012). Urban area in Aye Yeik Mon Housing Development, Hlaing Township (9 December 2013 and 28 January 2014).

Folk knowledge: A common folk belief in Myanmar is that having a resident Tokay will bring good fortune to the household, which confers some degree of protection to these lizards. Nonetheless, Tokay are harvested and sold to wildlife traffickers. Hunters search for Tokay at night with flashlights and capture them by hand, usually while wearing heavy leather gloves as protection. Hunters often pinpoint the location of Tokay by listening for their nocturnal vocalizations, particularly in natural habitats. Occasionally large trees containing cavities that shelter Tokay are felled and the cavities chopped open to extract geckos (Fig. 23B). Tokay are kept in large bottles and provided with cooked rice and living crickets until sold to wildlife traders.

Comments: The international trade in Tokay for traditional medicine is “colossal” with millions of geckos imported into southern China and Taiwan (CALLIBET, 2013). A novel trade centered on Peninsular Malaysia emerged in 2009 following reports that Tokay can cure HIV/AIDS (CALLIBET, 2013). This trade rapidly expanded throughout much of Southeast Asia and many populations of Tokay are thought to be declining (CALLIBET, 2013). Although quantita-

tive trade statistics are unavailable, Myanmar is thought to be a source country for Tokay appearing in markets of Peninsular Malaysia (CALLIBET, 2013). Interviews we conducted of rural villagers suggest Tokay are being harvested in Magway and Sagaing regions, and perhaps elsewhere. Interviewees told us that hunters in Myanmar can receive as much as US\$ 8,000 per Tokay, although we never found any individual who actually received such a large sum (the equivalent of five to six years of income for a rural villager). Wildlife traffickers reputedly purchase only large Tokay weighing at least 0.25 Viss (ca. 410 g), a body mass unlikely to be attained by this species. CALLIBET (2013) reported similar claims in Peninsular Malaysia, but found no credible evidence that such large sums were actually being paid for Tokay. Our many field records suggest Tokay remain common, even within anthropogenic habitats and some urban areas. If widespread over-exploitation of Tokay is occurring in Myanmar, the accessible populations in village and urban environs would likely be among the first extirpated. CALLIBET (2013) suggests Tokay is somewhat resilient in the face of hunting pressure owing to high fecundity, rapid growth, and ability to inhabit human-dominated landscapes.

Leiolepidae

Leiolepis peguensis (Pegu Butterfly Lizard)

Mandalay Region: Adult encountered in dense bamboo above Mile 4 Waterfall (9 December 2014); found about 15 cm from small burrow opening (2.5 cm in diameter) in dense bamboo forest among bamboo leaf litter.

Folk knowledge: According to villagers, *L. peguensis* is capable of feigning death when captured by a predator. Burrows are said to be constructed with two entrances to provide a means of escape in the event a predator (or hunter) attempts to excavate the burrow. These lizards are eaten by rural villagers. To harvest *L. peguensis*, hunters first locate the burrow entrances, and then construct a small fire in front of one entrance. Smoke is wafted into the burrow, causing the lizard to flee through an alternate entrance where the hunter waits. Hunters incapacitate or kill the fleeing lizard with a quick blow from a bamboo wand.

Scincidae

Eutropis multifasciata (Common Sun Skink)

Rakhine State: Adult photographed (Fig. 24) while basking on downed palm frond beside village house in Pauk Tu (16 June 2017). Adult basking among flood debris along banks of Kyet Chaung ca. 2.0 km upstream from Pauk Tu; shoreline habitat was fallow agricultural fields (17 June 2017).

Varanidae

Bengal Monitor (*Varanus bengalensis*)

Bago Region: Adult (TL = 1,120 mm; SVL = 500 mm) captured by dogs in mixed deciduous-evergreen forest near Zamari Chaung Camp (9 November 2016). **Magway Region:** Two freshly killed (<12 hours old) immature monitors (TL = 755 mm, SVL = 353 mm, and TL = 665 mm, SVL = 320 mm) examined at the home of farmer in Swelwe Kyin (28 May 2011). Both monitors were killed by farmer in recently cleared swidden field near village. Two monitors flushed by dogs as we searched for *Indotestudo elongata* in second-growth forest along Salin Chaung near Masatui (30 May 2011). **Sagaing Region:** Juvenile (TL ca.

500 mm) encountered along Nam Pelin Chaung (25°39'47"N; 95°33'30"E; altitude 135 m) in mixed evergreen forest of Htamanthi Wildlife Sanctuary (22 February 2014). Adult observed basking (TL ca. 800 mm) on log overhanging Nam Ei Su Chaung; shoreline habitat was dense grass and secondary forest in Htamanthi Wildlife Sanctuary (13 March 2014). Adult (TL ca. 1,000 mm) climbing utility pole in second-growth deciduous forest on grounds of Taw Ya Gyi Pagoda (5 November 2015).

Folk knowledge: *Varanus bengalensis* is widely harvested for domestic consumption in rural areas of Myanmar. Dogs are employed to capture and kill monitors. On occasion, monitors are taken with stand-off weapons such as slingshots (catapults) and muzzle-loading, black powder firearms.

Varanus salvator (Water Monitor)

Ayeyarwady Region: Juvenile (TL ca. 500 mm) in possession of hunters in Butalet Camp (17 May 2010); reportedly harvested along a stream in bamboo forest adjacent to the village. **Rakhine State:** Male (TL = 1,430 mm, SVL = 580 mm; Fig. 25A) killed by hunting dogs in evergreen forest near Ozzie Basecamp in Rakhine Yoma Elephant Sanctuary (27 May 2013). Stomach was filled with the crushed remains of a recently ingested freshwater crab. Female (TL = 940 mm [tip of tail missing], SVL = 550 mm, stomach empty; Fig. 25B) killed by hunting dogs in dense bamboo brake near Kanyin Gyauk Basecamp in Rakhine Yoma Elephant Sanctuary (29 May 2013). **Tanintharyi Region:** Trackways of large monitor found at marine turtle nesting beach on Kyauk Phyu Aw (10°53'34"N; 98°10'28"E; altitude <1m) in Lampi Marine National Park (15 December 2013). We attributed the trackway to *V. salvator* based on the length of rear-foot tracks (ca. 100 mm).

Folk knowledge: *Varanus salvator* is widely harvested for domestic consumption by rural villagers. In addition to being taken with dogs, *V. salvator* are captured in snares; firearms are sometimes used for reducing monitors to possession (see also *V. bengalensis* account). According to fishermen, *V. salvator* is a major predator of marine turtle eggs on islands in Lampi Marine National Park. At marine turtle nesting beaches in the park, fishermen excavate turtle nests and harvest eggs, but leave a few *in-situ* to attract predators. The excavated nest is then surrounded with a bamboo fence with occasional gaps left where "trip-up" snares are emplaced. Predators (including *V. salvator*) trigger the snare when passing through these openings. We witnessed the culinary preparation of two *V. salvator* in Rakhine State (Fig. 25b). Hunters first used a knife to vigorously scrape the skin and then the uneviscerated carcass was roasted in an open fire.

Comments: The distribution of *V. salvator* within Myanmar remains poorly understood (reviewed by SAI SEIN LIN OO & BATES, 2016). Older records from central and northern Myanmar are considered questionable by some (SAI SEIN LIN OO & BATES, 2016) and KOCH *ET AL.* (2010) failed to include Myanmar in the global distribution of *V. salvator*. However, *V. salvator* is known to occur in southern Thailand and presumably adjacent regions of southern Myanmar as well (COTA *ET AL.*, 2009) and recently was rediscovered in Kachin State (SAI SEIN LIN OO & BATES, 2016). Although SAI SEIN LIN OO & BATES (2016) suggest populations in Kachin State represent an isolated and perhaps relictual occurrence, our records suggest the distribution of *V. salvator* in Myanmar may be wider than previously supposed.



Figure 23. (A) Tokay (*Gekko gecko*) photographed at headquarters of Shwe Settaw Wildlife Sanctuary, Magway Region (17 October 2015). (B) Large tree felled by poachers to capture *Gekko gecko* at Shwe Settaw Wildlife Sanctuary. Note where cavity openings were enlarged to extract Tokays. Photographs by Steven G. Platt.



Figure 24. Common Sun Skink (*Eutropis multifasciata*) photographed while basking on downed palm frond beside village house in Pauk Tu, Rakhine State (16 June 2017). Photograph by Steven G. Platt.



Figure 25. (A) Water Monitor (*Varanus salvator*) killed by hunting dogs near Ozzie Basecamp, Rakhine State (27 May 2013). (B) Carcass of *V. salvator* taken near Kanyin Gyauk Basecamp, Rakhine State being roasted for human consumption (29 May 2013). Photographs by Steven G. Platt.

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Appendix 1. Geographic coordinates (India-Bangladesh datum in degrees, minutes, and seconds) and altitude of localities mentioned in text.

Location	Latitude (N)	Longitude (E)	Altitude (m)
Aung Myay	23°05'04"	96°14'11"	298
Ayaw Daw	22°56'21"	94°34'32"	164
Bagan	21°07'26"	95°51'02"	100
Bam Bwe	22°10'36"	96°38'11"	747
Chaung Wa	25°46'42"	95°31'43"	137
Boke Pyin	11°15'51"	98°45'41"	9
Butalet Camp	17°49'44"	94°56'50"	256
Chauk La Maing	11°16'49"	98°49'09"	17
Chaung Gwa	18°08'18"	96°16'33"	94
Chaung Lamu	11°51'21"	99°07'05"	21
Chaung Wa	25°46'42"	95°31'43"	137
Cone Gyi	18°23'15"	94°48'59"	NA
De Long Kone	21°27'36"	93°16'02"	482
Done Ahing Kyaw	18°07'26"	95°29'12"	8
Duyar In	17°33'27"	94°59'08"	220
Elephant Camp	23°01'40"	95°06'18"	238
Gaoyatgyi Kyun	15°41'03"	95°20'20"	1
Gwa	17°36'23"	94°35'30"	38
Hinthada	17°38'45"	95°27'26"	8
Hlaing	16°50'09"	96°06'53"	18
Hman Taung	22°18'23"	94°54'22"	184
Homalin	24°51'44"	94°54'39"	124
Hpasawang	18°52'42"	97°19'10"	122
Htamanthi	25°19'58"	95°17'38"	137
Htan Pinkone	17°47'15"	95°02'55"	25
Htan Pyin Gyaung	22°56'44"	94°36'26"	151
Kalay	23°11'26"	94°03'40"	150
Kalaywa	23°11'47"	94°18'19"	140
Kanaung	18°13'23"	95°22'51"	23
Kanyin Gyauk Basecamp	17°44'26"	94°40'27"	152
Karathuri	10°55'36"	98°45'36"	36
Khamthi	25°59'48"	95°42'06"	144
Khu Chaung	21°14'35"	94°09'55"	373
Kindat	23°43'25"	94°25'32"	108
Kone Pan	21°27'48"	93°18'05"	427

Appendix 1 (continued).

Location	Latitude (N)	Longitude (E)	Altitude (m)
Kone Pyin	17°46'40"	95°02'48"	31
Kyaukke	23°12'12"	94°11'11"	137
Kyauk Moe Kho Basecamp	17°43'27"	94°41'51"	214
Kauk Thaung	25°43'40"	95°27'04"	129
Kywe	23°03'53"	94°25'13"	92
Kyen Khar Kone Basecamp	17°54'35"	94°36'46"	23
Kyet Chaung	21°19'12"	93°11'23"	381
Kyun Daw	23°02'21"	94°40'18"	135
Le Taung Yar	12°03'38"	99°00'17"	26
Limpha	25°48'19"	95°31'44"	132
Ma Kyone Galet	10°41'04"	98°15'57"	3
Maliwone	10°15'08"	98°36'15"	43
Masatui	21°00'15"	94°01'28"	1167
Matupi	21°36'15"	93°27'48"	1202
Myauk Tayar Camp	15°59'08"	95°19'57"	3
Mile 24 Camp	18°05'01"	96°12'54"	277
Mile 34 Forest Camp	22°27'54"	94°39'16"	240
Mile 4 Waterfall	22°52'45"	96°00'23"	167
Mindat	21°22'15"	93°58'24"	1456
Min Pan Taung	22°37'19"	96°58'48"	207
Mol Dun (New Village)	25°27'43"	95°10'55"	274
Myanaung	18°17'29"	95°19'18"	27
Mya Sein Kyun	24°10'16"	94°41'32"	96
Mya Taung	21°26'54"	95°26'38"	NA
Myeik	12°25'03"	98°35'50"	15
Nam Mann	18°42'38"	97°40'30"	367
Nam Thalet Village	25°23'31"	95°16'20"	142
Nat Hmaw Do	22°21'14"	95°58'53"	80
Naung Pin	25°13'53"	95°07'15"	130
Nga Ohn	22°52'33"	94°33'56"	76
Nga Pwae Gyi	18°05'00"	95°58'28"	252
Ngwe Saung	16°50'15"	94°23'38"	11
Ozzie Basecamp	17°41'28"	94°39'13"	130
Padumone	26°00'55"	95°52'09"	183
Paletwa	21°18'12"	92°51'37"	22
Parpu	18°53'43"	97°19'12"	157

Appendix 1 (continued).

Location	Latitude (N)	Longitude (E)	Altitude (m)
Pauk Tu	18°16'29"	94°29'53"	30
Polaung Lay Camp	15°57'20"	95°16'36"	3
Pyay	18°49'00"	95°12'58"	21
Pyin Oo Lwin	22°02'04"	96°27'31"	1070
Sami	21°17'33"	93°06'00"	52
See Ma	20°52'41"	95°17'30"	447
Sendi Taung	21°22'03"	93°14'23"	910
Shan Inn Daw	11°57'35"	99°02'59"	17
Shwe Hlay	22°31'06"	96°00'23"	80
Six Mile Village	22°53'10"	96°03'30"	290
Soe Nay Kanaung	21°20'05"	93°09'54"	607
Soe Taw	20°18'47"	94°29'34"	76
Sone Inn Yan	25°25'12"	95°13'14"	154
Swelwe Kyin	21°00'41"	94°05'00"	485
Taw Ya Gyi Pagoda	22°16'06"	95°58'01"	152
Taung Dagon	11°07'06"	98°44'15"	24
Thabeiksay	22°19'06"	94°28'30"	365
Thanpaya	23°07'11"	94°25'33"	122
Thanthar ge	23°48'57"	94°33'01"	104
Thaung Chaung Camp	15°52'06"	95°13'50"	6
Thaw Ka – Kyet Chaung	18°15'50"	94°31'09"	32
Thit Sat Kone	23°04'57"	96°20'24"	176
Upper Pai	21°24'23"	93°15'09"	527
Wa Daw	25°25'39"	95°12'54"	163
Wah Ale Kyun	10°50'43"	98°04'24"	1
Walanpi	21°32'45"	93°21'45"	952
Wet Toe	22°36'19"	95°58'43"	70
Ya Haing Phyar	17°36'53"	94°37'08"	37
Ye Mar Pin	22°04'25"	94°53'54"	171
Ye Phyu	11°56'05"	99°04'28"	21
Yeh Naung U	23°05'42"	96°05'55"	178
Yuzana Camp	10°45'38"	98°41'40"	67
Zamari Chaung Camp	18°04'33"	96°02'16"	166
Zew Wei	12°13'18"	98°54'56"	23